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COMMUNITY METABOLISM AND AUTOTROPHIC - HETEROTROPHIC RELATIONSHIPS OF WOODLAND STREAM RIFFLE SECTIONS

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COMMUNITY METABOLISM AND AUTOTROPHIC-HETEROTROPHIC RELATIONSHIPS OF WOODLAND STREAM RIFFLE SECTIONS

By

Donna Kay King

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Kellogg Biological Station
and
Department of Fisheries and Wildlife

1982

ABSTRACT

COMMUNITY METABOLISM AND AUTOTROPHIC-HETEROTROPHIC RELATIONSHIPS OF WOODLAND STREAM RIFFLE SECTIONS.

By

Donna Kay King

Using an in situ chamber oxygen method at five first through third order riffle sites in Augusta Creek, Michigan, estimates of community metabolism were made on a monthly or seasonal basis (1973 - 1975). Combined site, net community productivity (NCP) ranged from -0.25 to 4.03 g O_2 $m^{-2}d^{-1}$, community respiration (CR) from 0.24 to 3.67 g O_2 $m^{-2}d^{-1}$, and gross community productivity (GCP) from 0.09 to 5.35 g O_2 $m^{-2}d^{-1}$. The integrative parameters net daily metabolism (NDM) and ratio of GCP to 24 hour CR (P/R) ranged from -0.72 to 2.68 g O_2 $m^{-2}d^{-1}$ and -0.017 to 2.5, respectively and remained constant at each site.

Most parameters were consistently low and stable at first order sites, while autotrophic sites varied significantly. Light-saturated photosynthesis occurred between 15,000 to 24,000 lux; no photoinhibition was evident.

Detrital standing crops were stable at each site and ranged from 146 to 592 g m^{-2}. Average ratio of coarse to fine particulate organic matter ranged from 0.12 to 0.4 with an inverse relationship with P/R. Epilithon values ranged from 1480 to 5030 g m^{-2}. Detritus averaged 12% of the total particulate organic matter. Epilithon was detrital based at first order riffles; other sites were algal dominated.

Average ratio of epilithon to detritus ranged from 4.5 to 14.8 with greatest seasonal differences at the autotrophic sites.

Stream order was most highly correlated with all dependent variables (NCP, CR, GCP, NDM) followed by light. Temperature and epilithon development were significantly correlated with all dependent variables; non-attached detritus had little correlation.

Particle-sized sediment (4 mm, 1 mm, 250 μm, 75 μm, 0.45 μm) contributions to NCP and CR were highest on 0.45 μm detritus and 4 mm (NCP) and 75 μm (CR) inorganic sediments on an AFDW basis. Areal estimates indicated highest NCP on larger inorganic and organic particles; highest CR occurred on 0.45 μm detritus and 4 mm inorganic particles. CR was highest on all detrital fractions on an AFDW basis; epilithon had higher contributions to NCP and CR on an areal basis. *In situ* trends were similar to areal particle-sized estimates. The support of woodland stream riffle sections was dependent on epilithon development while the autotrophic-heterotrophic balance was dependent upon the floral composition.

This work is dedicated to Matthew H. Hohn.

Who introduced me to the finer (diatomaceous) things of life.

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INTRODUCTION

> As the sun proceeds slowly northward warming and lighting
> the temperate streams, a golden glow results on rocks,
> stones, and logs, announcing another diatomaceous spring...
> 20 March 1974 Augusta Creek

Interest in primary production of autotrophic organisms ranges from world wide support of the human population to unraveling the complex functions of ecosystems (MacFaden 1948, Wetzel 1975). Although there was early notice of primary producers and their importance in aquatic systems, it was not until 1944 that in-depth inquiries were begun. These early studies on lakes are summarized by Wetzel (1965, 1975a) and Lieth (1975). Early productivity studies on lotic systems are minimal (Odum 1956). Lotic systems are extremely heterogeneous and dynamic in all aspects. Besides the typical physical, chemical, spacial, and biological variables common in lentic systems, one studying lotic systems encounters variability in canopy cover, substrate distribution, and current; which in turn affect niche availability and distribution of organisms at all levels of food webs. These variables, along with watershed effects through runoff, flooding, and perturbations by man, are reviewed by Hynes (1970) and Whitton (1973), and their applicability to measurement of primary productivity discussed by Hynes (1970) and Wetzel (1975b). Methodology for estimating primary productivity in aquatic systems has been extensively reviewed (Ryther 1956b, Goldman, 1969, Vollenweider 1969, Hall 1973, Hall and Moll 1975, Bott et al. 1982).

At the time of this investigation (1973 - 1975) no published *in situ* investigations had been made using chambers under natural field conditions in streams. Since this study, however, *in situ* measurements of community metabolism have been reported (Göthberg and Karlström 1975, Marker 1976b, Naiman 1976, Litke 1978, Pennak and Lavelle 1979, Sumner and Fisher 1979, Bush and Fisher 1981, Hornick et al. 1981), and a comparative study of three chamber techniques, including the chamber designed for this study (King chamber), and two open water techniques for estimating community metabolism has been completed (Bott et al. 1975). Although *in situ* chamber methods are beginning to take the forefront in the determination of community metabolism, Pennak and Lavelle (1979) and Rodgers et al. (1980) reinforce the lack of such data and the need to continue with this type of approach to examine ecological questions concerning community metabolism.

It was the purpose of this investigation to estimate *in situ* levels of community metabolism for selected riffle sections of the Augusta Creek watershed over a two-year period and to examine the autotrophic-heterotrophic relationships within these communities through measurement of autochthonous production and community respiration with subsequent calculation of the integrative parameters the ratio of gross community productivity to 24 hour community respiration (P_G/R_{24} = P/R) and net daily metabolism (NDM). First through third order (Strahler 1957) sites were examined to elucidate changes in community metabolism throughout the headwater portion of the watershed and the effects of light and temperature on the rates of in situ productivity. Relationships of detrital and epilithon standing crops to community metabolism were also examined. The major hypotheses were that the shaded first order sections obtain minimal support through autotrophic pathways, which would indicate a heterotrophic dependence, while the open second and third order reaches would be supported by an autotrophic energy base over the annual period and that clearing of riparian vegetation from third order sections would increase the autotrophic potential of the riffle community.

Estimates of community metabolism have been shown to reflect environmental changes due to pollution (Odum 1956) or short term stress such as application of lampricides (Maki 1974). The P/R ratio and NDM are also of value in characterizing autotrophic-heterotrophic relationships in aquatic systems. Odum (1956), using P/R ratios from open water estimates, indicated the significance of this ratio in the classification of stream communities based on their major carbon source. He classified communities which received large amounts of allochthonous carbon in which respiration was greater than gross production ($P/R < 1$) as heterotrophic, while those in which there was much autochthonous production of carbon ($P/R > 1$) were termed autotrophic. This relationship has been established as a physiological classifier of streams by Caspers and Karke in 1966 and 1967 as reviewed by Pavletic et al. (1976). Hynes (1970) commented on the little attention that this valuable parameter had received in lotic systems. Fisher and Likens (1973) expanded on this relationship by incorporating estimates of export and import. Minshall (1978) reported $P/R < 1$ in aquatic plant-dominated lotic reaches, which indicated the possibility of heterotrophic conditions in communities producing large amounts of autochthonous carbon. This carbon, however, is available to the community mainly when converted to detritus, often downstream, which indicates the heterotrophic nature of the riffle due to low attached algal development from shading by aquatic macrophytes. Estimates of NDM (gross community production minus 24 hour community respiration) yield a valuable quantitative measure of support or dependence of a community on allochthonous carbon sources (Bott et al. 1978, Vannote et al. 1980).

The heterotrophic nature of headwater streams and the importance of allochthonous inputs of organic carbon such as leaves, twigs, flower parts, bark, fine particulate organic matter (FPOM), and dissolved organic matter (DOM) is well documented as is the decomposition of these materials by bacteria, fungi, and macroinvertebrates within the deciduous biome (Minshall 1967; Kaushik and Hynes 1968, 1971; Triska 1970; Hynes 1970; Coffman et al. 1971; Cummins et al. 1973; Suberkropp and Klug 1974; Cummins 1974, 1975a, 1977, 1978, Suberkropp et al. 1976, Bell et al. 1978, Vannote et al. 1980). These studies indicate that heterotrophic stream sections receive as little as one percent of their carbon from autochthonous production.

Observations of forested areas of Augusta Creek, a woodland Michigan stream, indicated epilithic, epipsammic and epipelic algae were present, as well as high populations of algal-feeding aquatic insect larvae (scrapers; Merritt and Cummins 1978) such as *Glossosoma* and *Neophylax* (Trichoptera:caddisflies). Wetzel (1975b) and Minshall (1978) emphasized that in order to use an autotrophic-heterotrophic classification system one must first know the magnitude of community production and not assume autotrophic insignificance. *In situ* measurements of community metabolism not only estimate productivity, but total community production, which includes both autotroph and heterotroph (bacterial, fungal, and invertebrate) metabolism (Wetzel 1975b, Bott et al. 1978, Pennak and Lavelle 1979). Such estimates are directly dependent on light, temperature, carbon dioxide, and oxygen levels and indirectly on inorganic and organic nutrient availability, which all affect photosynthesis and respiration (Lieth 1975; Wetzel 1975a, 1975b). Intensive investigation of the effects of these parameters on *in situ* community metabolism has not been completed. The extent to which autotrophic communities develop and contribute to the structure and function of woodland streams needs to be addressed.

DESCRIPTION OF STUDY SITE

> The pussywillows have popped their bud scales and the *Cornus* with a blushing glow awakes from it's dull red winter slumber! They now await the stirring of leaf buds... Spring is in the air at Augusta Creek.
> 5 March 1974

Augusta Creek, a woodland stream located in Barry and Kalamazoo counties, Michigan, was the site of this investigation (Figure 1). This third order (Strahler 1957) stream system joins the Kalamazoo River in Augusta, which in turn flows westerly into Lake Michigan at Saugatuck. The watershed has been described by Mahan and Cummins (1974) as having a total length of 73.3 km (39.3 mi) and a drainage area of 72.3 km^{-2} (27.9 mi^{-2}). The watershed includes a combination

SITES:

U = Upper 43rd

S = Smith

B = B Avenue

N = Nagel

K = Kellogg
Forest

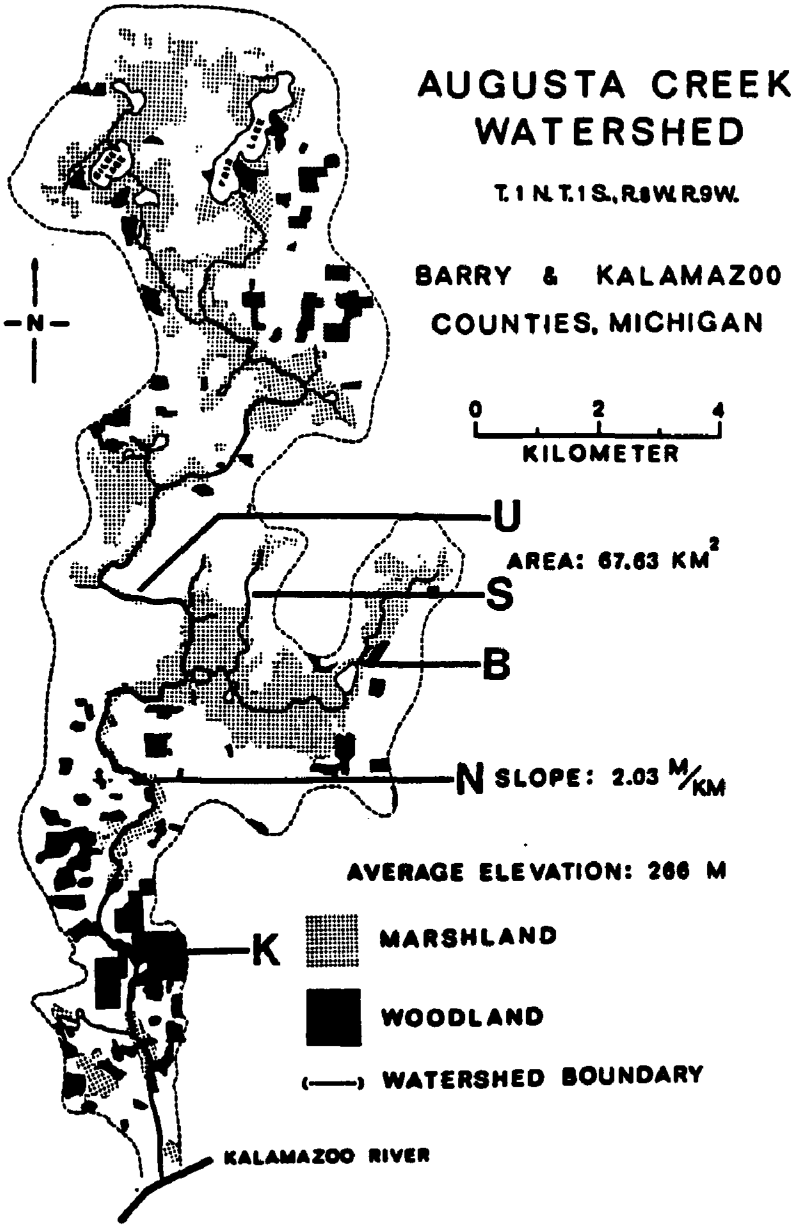


Figure 1. Augusta Creek watershed, Barry and Kalamazoo counties, Michigan (modified from Manny and Wetzel 1973).

of forested, meadow, and agricultural reaches with approximately 50% of the drainage in agricultural use (King 1979, Mahan 1980). The slope is slight, 2.03 $m^{-1}km^{-1}$ (Manny and Wetzel 1973), and discharge measured at the United States Geological Survey gauging station in Augusta (Figure 2) ranged from 8.72 $m^{-3}s^{-1}$ (308 cfs) in 1975 to 0.27 $m^{-3}s^{-1}$ (9.5 cfs) in 1970 and averaged 1.19 $m^{-3}s^{-1}$ (42 cfs) (Mahan and Cummins 1974). King (1978) gives weekly velocities and discharge values for the B Avenue, Nagel and Kellogg Forest Sites from 1973 to 1974 and discharge records from 1976 to 1977 at these sites plus Smith and Upper 43rd Sites are cited in Mahan (1980). The range and average discharge values for the sites selected for this investigation are summarized in Table 1.

Augusta Creek is characterized as a hardwater stream with pH values of 7.5 to 8.7, alkalinity of 160 to 230 $mg^{-1}l^{-1}$, and total hardness of approximately 280 $mg^{-1}l^{-1}$ $CaCO_3$ (Manny and Wetzel 1973, Mahan and Cummins 1974, King 1978). Inorganic nitrogen levels ranged from 2 to 5 $mg^{-1}l^{-1}$ and orthophosphate from 10 to 40 $\mu g^{-1}l^{-1}$ during a diel study by Manny and Wetzel (1973).

The present investigation concentrated on riffle sections of two sites in Augusta Creek (B Avenue and Nagel) during 1973-1974, while riffles of five sites (Smith, B Avenue, Upper 43rd, Nagel, and Kellogg Forest) were studied in 1974-1975 (Figures 1 and 2). The Smith Site typifies a natural first order site within the Augusta Creek watershed and joins the B Avenue tributary before confluence with the Upper 43rd reach (Figures 1, 2, 3). The B Avenue first order reach originates in a tamarac (_Larix larcina_) area, flows southwest through an agriculturally perturbated section where cattle have free access to

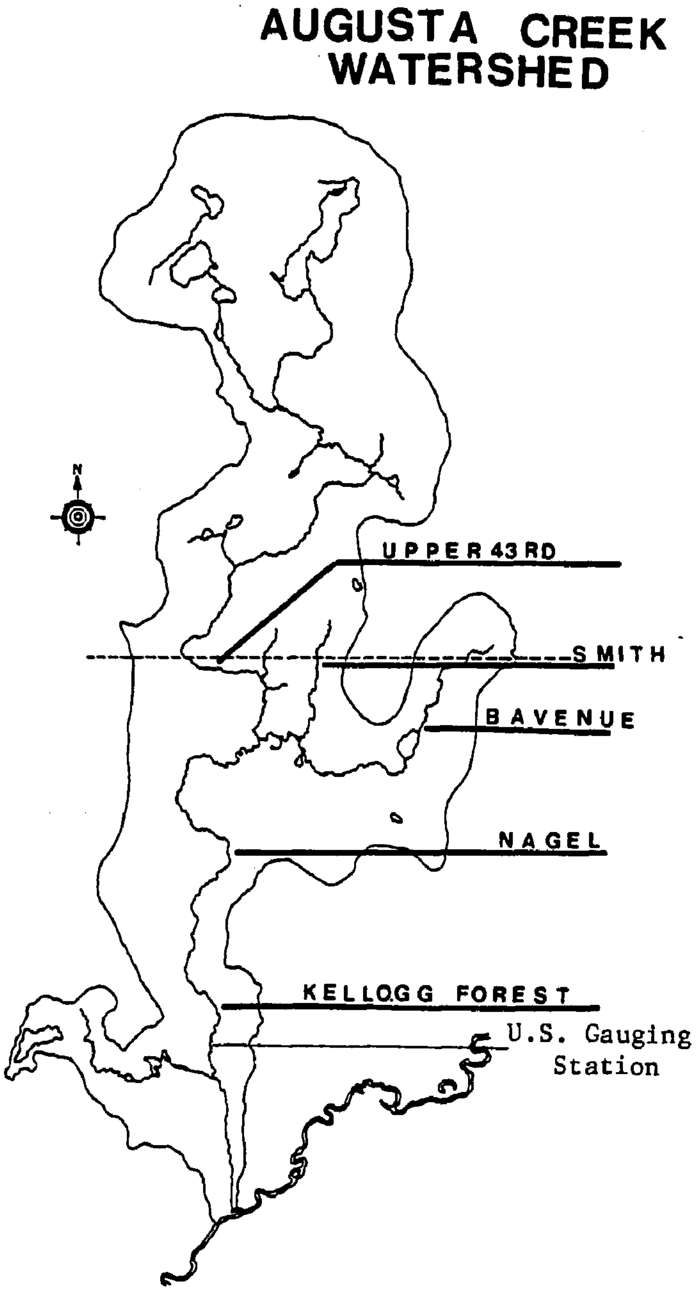


Figure 2. Community metabolism study sites selected in the Augusta Creek watershed (Kalamazoo and Barry counties, Michigan).

Table 1. Physical parameters of selected study sites, Augusta Creek, Kalamazoo County, Michigan (1973-1977).

		TEMPERATURE °C		DISCHARGE m^3 s^{-1}		
SITE	ORDER	RANGE	$\bar{x}$	MAXIMUM	MINIMUM	$\bar{x}$
SMITH*	1	0-25.6	9.3	0.257	0.004	0.013
B AVENUE**	1	0-24.6	8.7	0.400	0.030	0.070
UPPER 43rd*	2	0-29.6	10.7	2.100	0.290	0.643
NAGEL**	3	0-28.4	10.7	3.30	0.400	1.130
KELLOGG FOREST**	3	0-27.2	10.5	3.470	0.430	1.200

* Data from Mahan (1980)

** Data from King (1978) and Mahan (1980)

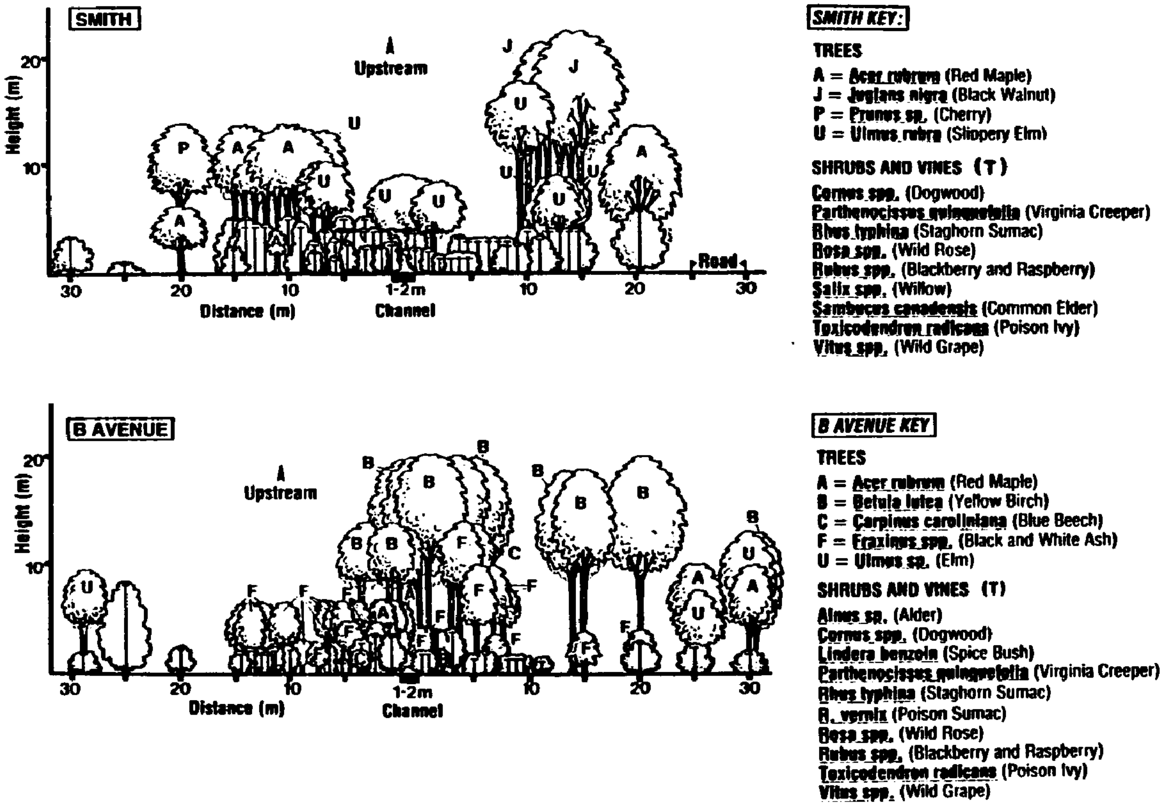


Figure 3. Woody vegetation profiles of Smith and B Avenue sites, Kalamazoo County, Michigan (1975).

the stream, then flows into Hamilton Lake (Figures 1, 2, 3). The second order Upper 43rd meadow reach is within the tributary started by Gilkey and Fair Lakes and is downstream from Lawrence Lake (Figure 1); it joins the B Avenue - Smith tributary to form a third order system. The third order Nagel Site, located near the center of the drainage is an open reach influenced by swimming, fishing and vegetation removal (Figures 1, 2, 4). Along the east bank riparian vegetation was present, but in places the west bank was a mowed lawn (Figure 4). The Kellogg Forest Site is owned and maintained in a "natural" forested condition by Michigan State University and is open to the public for fishing. It is located downstream from the cleared Nagel site and provided a comparison of forested and cleared third order reaches.

Percent cover, as well as the major woody canopy components, determined from transects (30 m x 1 m) established perpendicular to the stream banks are illustrated in Figures 3 and 4. The narrow Smith and B Avenue reaches were heavily shaded and contrast with the open meadow reaches of Upper 43rd and Nagel Sites. The Kellogg Forest Site, was a shaded third order reach along Augusta Creek. An extensive analysis of the woody vegetation for these five sites was made by Mahan (1980). Of the 41 taxa observed in the herbaceous understory of the transects only five had abundant (> 50% occurrence) or common (> 10% occurrence) status (July 1974). Sedges (*Carex* spp.) were common or abundant at all sites except B Avenue, Grasses (Graminae) were common at Nagel Site, skunk cabbage (*Symplocarpus foetidus* (L.) Nutt.) was common at B Avenue, goldenrods (*Solidago* spp.) at Upper 43rd site, and forget-me-knots (*Myosotis* sp.) were

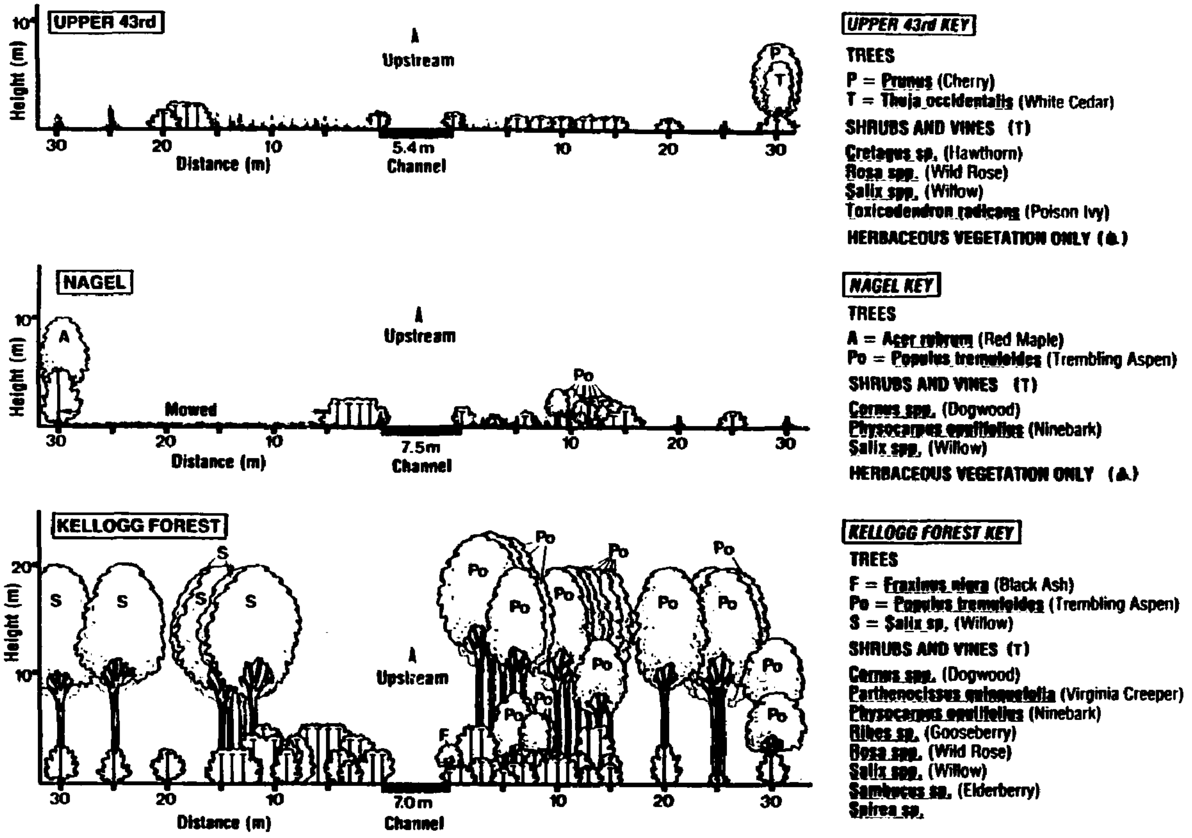


Figure 4. Woody vegetation profiles of Upper 43rd, Nagel, and Kellogg Forest sites, Augusta Creek, Kalamazoo County, Michigan (1975).

common at the Kellogg Forest (Table 2). At Upper 43rd and Nagel Sites emergent vegetation was present as well, including Peltandra virginica (L.) Kunth. and Saggittaria latifolia Willd. During the summer at the Nagel Site, much of the riffle was covered by submergent S. latifolia, Sparganium, Potamogeton pectinatus L., and P. nodosis Poir.

The physical composition of the sediments for the five sites, after Cummins (1962), was determined by particle-sizing into the following categories: pebbles (> 16 mm), gravel (> 4 mm), very coarse sand (> 1 mm), medium sand (> 250 μm), and very fine sands (> 75 μm). All sites were dominated by the larger particle-sizes with 65 to 81 percent composition of 16 and 4 mm substrates (Figure 5). The Smith and B Avenue Sites were very similar and on the lower end of the average (65 and 66% respectively), while the Upper 43rd (76%), Nagel (81%) and Kellogg Forest (77%) Sites were similar and had a higher proportion of particles greater than 16 mm in diameter. Travertine deposits were noticeable on the rocks at Upper 43rd, and Nagel, which reflected increases in photosynthetic activity and the alkaline nature of the water; travertine was absent at Smith and B Avenue, and intermediate in development at Kellogg Forest.

The macroinvertebrates, which accounted for greater than 10% of the standing crop over an annual period, included 19 taxa: five mayflies (Ephemeroptera), five caddisflies (Trichoptera), one riffle beetle (Coleoptera), six dipterans with a predominance of midges (Diptera), the amphipod Gammarus, and a water mite (Hydracina) (Table 3). The B Avenue Site had the highest number of common taxa (13), although the overall diversity was highest in the open reaches (Table 3).

Table 2. Percent coverage and abundance of herbaceous plants from ten meter transects established perpendicular to each bank at five sites of Augusta Creek, Kalamazoo County, Michiagn, July 1975.

		SMITH			B AVENUE			UPPER 43rd			NAGEL			KELLOGG FOREST		
TAXON	COMMON NAME	L	R*	TA**	L	R	TA	L	R	TA	L	R	TA	L	R	TA
Bryophyta	moss	8	10	R	3	2	R	-	-	-	-	1	R	2	4	R
Arthrophyta																
Equisetum sp.	horsetails	1	-	R	8	1	R	-	7	R	4	1	R	-	-	-
Pterophyta																
Dryopteris sp.	shieldfern	-	-	-	-	-	-	-	-	-	-	4	R	-	-	-
Onoclea sensibilis L.	sensitive fern	6	11	R	-	14	R	-	-	-	-	-	-	-	17	R
Magnoliophyta																
Typhaceae																
Typha latifolia L.	common cattail	-	-	-	-	-	-	-	-	-	2	-	R	-	-	-
	grasses	<1	1	R	1	2	R	<1	10	R	50	4	C	<1	4	R
Gramineae																
Cyperaceae																
Carex spp.	sedges	52	33	C	2	12	R	72	28	A	3	54	C	-	44	C
Scirpus atrovirens Willd.		-	-	-	-	-	-	-	-	-	1	-	R	-	-	-
S. validus Vahl.	great bulrush	-	-	-	-	-	-	-	-	-	1	-	R	-	-	-
Araceae																
Symplocarpus foetidus (L.) Nutt.	skunk cabbage	1	-	R	19	26	C	-	-	-	-	-	-	3	1	R

Table 2. (cont'd.)

		SMITH			B AVENUE			UPPER 43rd			NAGEL			KELLOGG FOREST		
TAXON	COMMON NAME	L	R*	TA**	L	R	TA	L	R	TA	L	R	TA	L	R	TA
Iridaceae																
Iris sp.	wild iris	1	-	R	-	-	-	1	2	R	-	-	-	-	-	-
Urticaceae																
Urtica sp.	nettle	-	-	-	2	-	R	-	-	-	-	-	-	-	-	-
Ranunculaceae																
Caltha palustris L.	marsh marigold	1	1	R	1	1	R	-	-	-	-	-	-	-	-	-
Ranunculus sp.	buttercup	8	2	R	3	10	R	1	-	R	-	-	-	-	<1	R
Thalictrum sp.	meadow rue	<1	-	R	1	-	R	3	-	R	-	2	R	-	-	-
Brassicaceae																
Berteroa incana (L.) DC	hoary allysum	-	-	-	-	-	-	-	2	R	-	<1	R	-	-	-
Rosaceae																
Fragaria virginiana Duchesne.	wild strawberry	<1	-	R	-	-	-	1	-	R	-	-	-	-	-	-
Potentilla sp.	cinquefoil	-	-	-	-	-	-	1	-	R	-	-	-	-	-	-
Fabaceae																
Trifolium pratense L.	red clover	-	-	-	-	-	-	-	-	-	9	-	R	-	-	-
Geraniaceae																
Geranium maculatum L.	wild geranium	-	-	-	-	-	-	-	-	-	-	1	R	-	-	-
Balsaminaceae																
Impatiens balsamina L.	jewelweed	2	5	R	1	2	R	-	<1	R	<1	-	R	<1	<1	R

Table 2. (cont'd.)

TAXON	COMMON NAME	SMITH L	SMITH R*	SMITH TA**	B AVENUE L	B AVENUE R	B AVENUE TA	UPPER 43rd L	UPPER 43rd R	UPPER 43rd TA	NAGEL L	NAGEL R	NAGEL TA	KELLOGG FOREST L	KELLOGG FOREST R	KELLOGG FOREST TA
Violaceae																
Viola sp.	violet	-	1	R	-	1	R	-	-	-	1	-	R	1	-	R
Lythraceae																
Lythrum salicaria L.	purple loostrife	-	-	-	-	-	-	-	-	-	-	-	-	3	<1	R
Apiaceae																
Angelica atropurpurea L.	-	-	-	-	-	-	-	2	1	R	-	10	R	-	-	-
Cicuta bulbifera L.	-	3	2	R	-	-	-	-	2	R	-	5	R	-	-	-
Daucus carota L.	wild carrot	-	-	-	-	-	-	-	1	R	-	-	-	-	-	-
Primulaceae																
Lysimachia ciliata L.	-	-	-	-	-	-	-	1	-	R	-	-	-	-	-	-
Asclepidaceae																
Asclepias sp.	milkweed	-	-	-	-	-	-	1	1	R	1	<1	R	-	-	-
Boraginaceae																
Myosotis sp.	forget-me-not	-	-	-	-	-	-	-	-	-	-	-	-	53	-	C
Verbenaceae																
Verbena sp.	vervain	-	-	-	-	-	-	-	-	-	1	1	R	-	-	-
Lamaraceae																
Lycopus americanus Muhl.	water horehound	-	-	-	-	-	-	-	-	-	<1	<1	R	1	-	R

Table 2. (cont'd.)

		SMITH			B AVENUE			UPPER 43rd			NAGEL			KELLOGG FOREST		
TAXON	COMMON NAME	L	R*	TA**	L	R	TA	L	R	TA	L	R	TA	L	R	TA
Prunella vulgaris L.	self-heal	<1	-	R	1	-	R	-	-	-	1	-	R	<1	-	R
Rubiaceae																
Galium sp.	bedstraw	10	1	R	1	3	R	<1	<1	R	-	1	R	1	1	R
Lobeliaceae																
Lobelia sp.	-	-	2	R	-	-	-	1	1	R	5	-	R	-	-	-
Asteraceae																
Cirsium sp.	thistle	1	1	R	-	-	-	-	-	-	-	-	-	-	-	-
Erigeron sp.	fleabane daisy	2	-	R	-	-	-	-	-	-	-	-	-	-	-	-
Eupatorium maculatum L.	joe-pye weed	-	1	R	-	-	-	3	8	R	4	3	R	-	1	R
E. perfoliatum L.	boneset	-	-	-	-	-	-	-	-	-	1	-	R	-	-	-
Rudbeckia hirta L.	black-eyed susan	-	-	-	-	-	-	-	-	-	-	1	R	-	-	-
Solidago sp.	goldenrod	4	1	R	-	1	R	10	28	C	-	3	R	1	4	R
Taraxacum officinale Weber	common dandelion	<1	-	R	-	-	-	-	1	R	10	-	R	-	-	-
unknowns		5	3	R	5	1	R	-	1	R	-	4	R	1	6	R
Total Taxa				23			16			21			28			16

---

* L = left bank
R = right bank

** TA = total abundance ($\bar{x}$ percent coverage for the site)
A = abundant = greater than 50%
C = common = greater than 10%; less than 50%
R = less than 10%

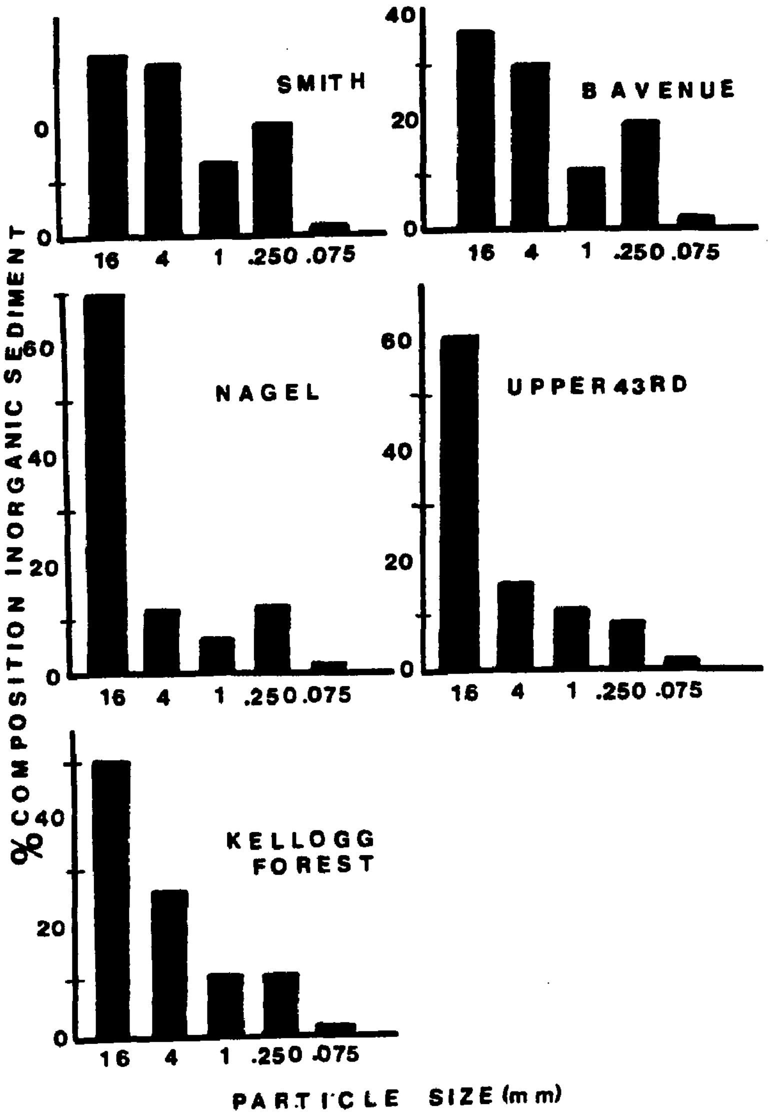


Figure 5. Percent composition of particle-sizes from riffle section inorganic sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

Table 3. Abundant and common macroinvertebrates from selected riffle sections of Augusta Creek, Kalamazoo County, Michigan (1974-1975).

Taxon	Smith	B Avenue	Upper 43rd	Nagel	Kellogg Forest
EPHEMEROPTERA					
Baetidae	-	C*	-	C	-
Ephemerella	-	C	-	-	C
Stenonema	-	C	C	-	-
Caenis	-	C	-	-	-
Hexagenia	-	-	C	-	-
TRICHOPTERA					
Hydropsychidae	-	C	C	C	C
Psychomyeiodae	-	-	C	C	C
Neophylax	-	C	-	C	C
Glossosoma	-	C	-	-	-
Protoptila	-	-	-	C	-
COLEOPTERA					
Elmidae	-	C	C	C	C
DIPTERA					
Chironomidae	A**	A	A	A	A
Simulidae	A	C	-	-	-
Atherix	-	C	-	-	-
Antocha	-	-	C	-	-
Eriocera	-	C	-	-	-
Dicranota	-	C	-	-	-
AMPHIPODA					
Gammarus	A	-	-	-	-
ARCHNIDA					
Hydracina	-	-	-	C	C
TOTAL (C and A)	3	13	7	8	7
TOTAL SPECIES	(15)	(19)	(30)	(30)	(29)

* C = common (> 10% < 50%)
** A = abundant (> 50%)

METHODS

> Indeed the spring diatom bloom is such a pleasant snake free period on Augusta Creek... 5 March 1974

Estimates of community metabolism were measured over a two year period (1973-1975) in five selected riffle sections of Augusta Creek, Michigan, using an *in situ* chamber technique (Figure 2). Circular chambers, illustrated in Figure 6, were constructed of 3.2 mm (1/8") thickness Plexiglas cylinders of telescoping diameters. The bottoms were 21.5 cm in diameter by five cm deep, while the lids were 22 cm in diameter by approximately 10.2 cm in height. A hole was cut in the lids for the insertion of a stopper in which a YSI (Yellow Springs Instrument Co.) self-stirring oxygen probe (Model 5420-A) was mounted. All bottoms and dark lids were opaqued with Krylon flat black paint and covered with two layers of black electricians tape applied in opposite directions to prevent light penetration (APHA et al. 1971). Chambers were 0.036 m^{-2} in area, held approximately 1500 ml of sediment and three liters of water.

Chamber bottoms were filled with natural substrate and buried in riffle sections of Augusta Creek (Figures 1 and 2) where they were allowed to recolonize at least one month prior to experimentation.

Just prior to an experiment YSI oxygen meters (Model 51-A temperature compensating) and oxygen probes were calibrated with oxygen probes in 100% humidity chambers which were submersed in the stream and equilibrated to stream temperature. Water samples were taken with a VanDorn water sampler and fixed in the field for Winkler titration of dissolved oxygen (APHA et al. 1971) at the beginning and

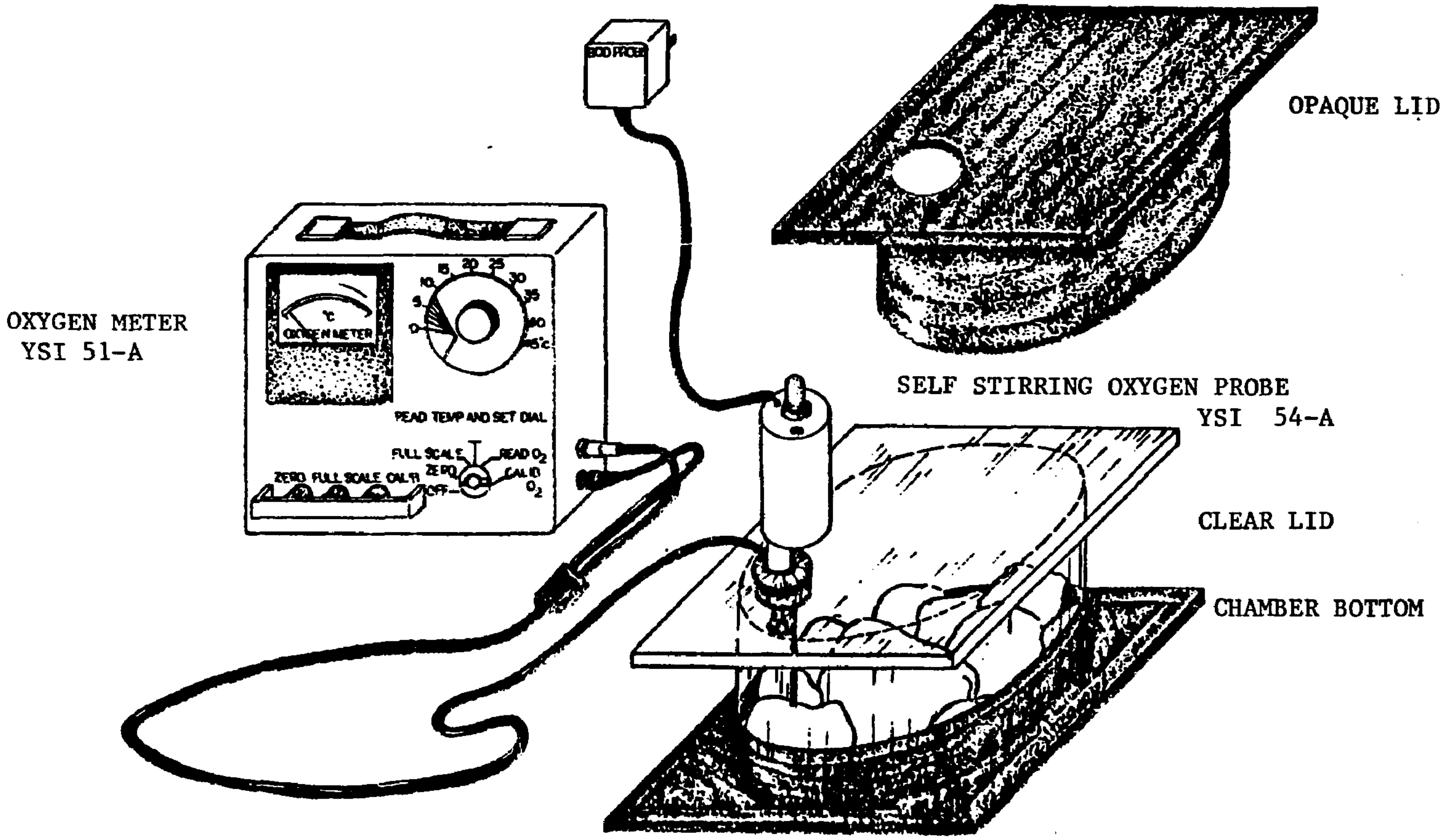


Figure 6. Plexiglas chamber designed for estimating community metabolism in stream riffle sections.

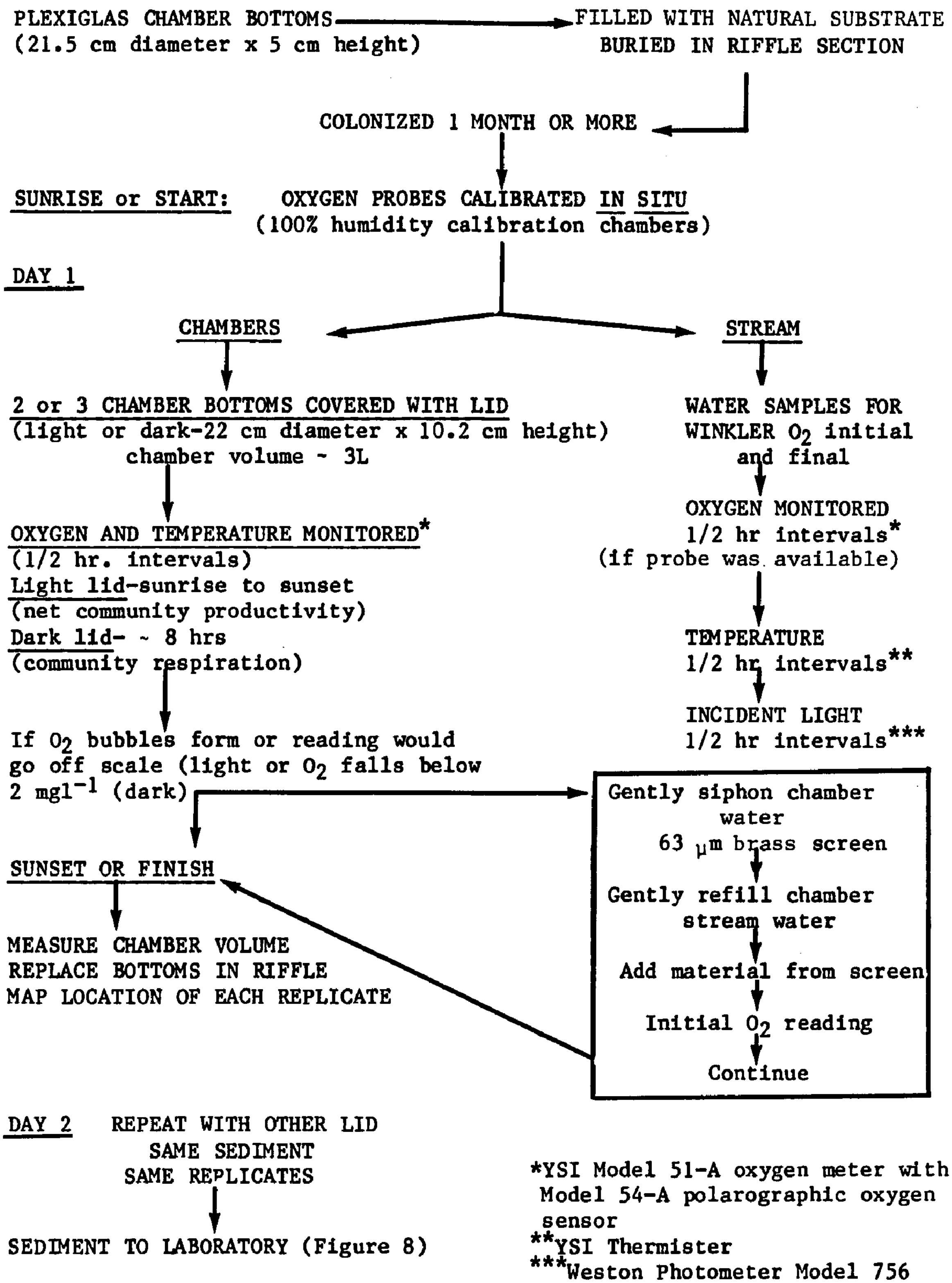
end of each experiment to check probe calibration. An average deviation of $\pm$ 0.5 mg O_2 l^{-1} (n = 38) was found from Winkler results for initial oxygens, while $\pm$ 0.04 mg O_2 l^{-1} was the average deviation of final titrations (n = 38). The precision of the YSI probe system was $\pm$ 0.2 mg O_2 l^{-1} (Yellow Springs Instrument Co.). Checks on probe drift and oxygen consumption of empty chambers were run at room temperature in the laboratory and in temperature controlled experimental stream channels with no significant changes observed ($\pm$ 0.2 mg O_2 l^{-1}).

A complete field procedure diagram is illustrated in Figure 7. At the start of an experiment, Plexiglas viewers were used to locate chamber bottoms in the substrate. Markers were not used so the bottoms would remain inconspicuous in the sediments. the first two or three bottoms located in the predawn light were selected as replicates, provided they were not washed out. This method of selection was considered random.

Plexiglas lids were placed over each chamber and due to the closeness of fit, plus layers of electrician's tape, a tight seal was obtained (chambers could be lifted out and set on the stream bank with no water loss). Half-hour changes in oxygen and temperature were monitored using polarographic oxygen sensors equipped with electric stirrers. The stirrer provided a current within the chamber to better simulate stream conditions. although the flow was not laminar, it was sufficient to thoroughly mix the water within the chamber, as evidenced by the almost instantaneous dispersal of test dyes or observations of attached detritus and algae that indicated swaying to be similar to that outside of the chamber. Laboratory and field

Figure 7. Experimental design of *in situ* community metabolism field experiments.

FIELD PROCEDURE



*YSI Model 51-A oxygen meter with Model 54-A polarographic oxygen sensor

**YSI Thermister

***Weston Photometer Model 756

Figure 7.

studies have indicated currents of less than 15 to 2 cm s^{-1} affect CR and mineral uptake in lotic systems (Odum and Hoskin 1957; Whitford and Schumacher 1961, 1964; Pfeifer and McDiffett 1975). The oxygen-probe stirrer is designed to create a current of at least 10 cm s^{-1} over the membrane (YSI Instrument Co.). Estimates of community metabolism obtained with these chambers compared favorably (within expected variation for the reach) with those in which laminar flow was provided (Bott et al. 1978). The stirrer was run in the field using 12 volt car batteries and a Wards Power Verter (Model 2V200B).

Each experiment consisted of a two day sampling period. One day a light lid was placed over each replicate chamber to monitor net community productivity (NCP) from sunrise to sunset and the second day to monitor community respiration (CR) on the same substrate dark lids were employed (days were always consecutive). Dark runs were for variable lengths of time (generally daylength), but continued until an oxygen change of at least 2 mg l^{-1} occurred, which placed measurement error at 10% ($\pm$ 0.2 mg l^{-1}). Dark runs followed by diel light runs were completed at the B Avenue and Nagel sites to compare CR rates obtained during daylight and dark periods. There were no measurable differences in the two rates, therefore daylight monitoring of CR continued (Table 4).

Stream temperatures and levels of incident light were also monitored at half-hour intervals, using a YSI Thermister or a mercury thermometer and a Weston Photometer (Model 756), respectively.

At experiment termination the chamber volumes were measured and the sediments taken back to the laboratory for removal of detrital content through decanting, and sorting of macroinvertebrates (Figure

Table 4. Comparison of community respiration rates obtained during daylight and dark periods from selected riffle sites of Augusta Creek, Kalamazoo County, Michigan.

Date	Site	Dark Chamber $\bar{x}$ g O_2/m^2h^{-1} - range	Light Chamber-Night $\bar{x}$ g O_2/m^2h^{-1} - range
07 June 1973	B Avenue	0.029 (0.021-0.037)	0.028 (0.025-0.031)
29 May 1974	Nagel	0.082 (0.063-0.100)	0.079 (0.068-0.089)

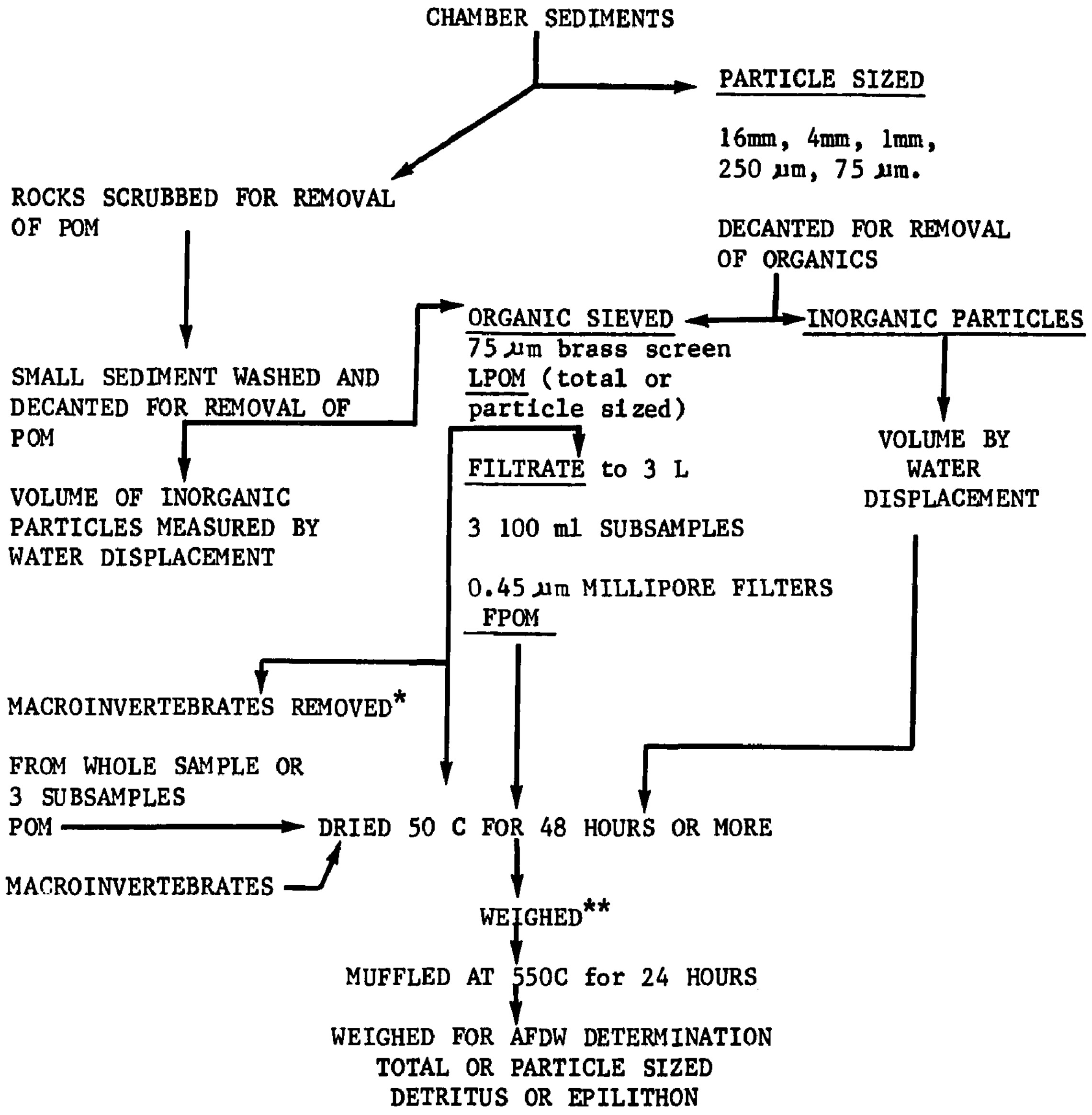
7). During the second year of sampling, the organic content of attached periphyton assemblages, and POM and algae incorporated in the travertine, was determined by ashing and reported as epilithon (g AFDW m^{-2}; Figure 8). All POM was oven dried at 52 C to a constant weight (48 hours or greater). Ash free dry weight (AFDW) was obtained by ashing at 550 C for 24 hours (Figure 8). When epilithon AFDW was determined, detritus was gently elutriated from the inorganic sediments; then materials were collected separately, particle sized and AFDW determined for both components.

Macroinvertebrates were removed from either entire chamber sediments or subsamples (40 ml of 500 ml) of a sediment slurry (Figure 8). Using Chi-Square analysis for random distribution of organisms, it was determined that subsampling was adequate ($P < 0.05$) to estimate this component (Elliott 1971). Macroinvertebrates were dried (52 C) and AFDW determined as for sediments.

Duplicate estimates of community metabolism were completed on a monthly basis at the B Avenue site from January 1973 through May 1974 and at the Nagel site from August 1973 to August 1974. Seasonal estimates were made at five sites (Smith, B Avenue, Upper 43rd, Nagel and Kellogg Forest) from October 1974 through July 1975). Seasons were delineated as follows: Fall - September through November, Winter - December through February, Spring - March through May, and Summer -June through August.

Parameters calculated are listed and defined in Table 5 (Hewlett-Packard 2100A Mini Computer). Regression analyses, involving individual estimates of NCP and CR and averages of the parameters listed in Table 5 with the independent variables light, temperature

LABORATORY PROCEDURE



* Wild dissecting microscope model M-5 (50x).

** Mettler H-16 (organic) - Mettler P-163 or E-1000 (inorganic).

*** Thermolyne model F-41730 muffle furnace.

Figure 8. Laboratory procedure for determination of ash-fee dry weight (AFDW) of chamber sediments and macroinvertebrates.

Table 5. Procedure for estimating parameters of community metabolism experiments.

Parameter	Definition
Net Community Productivity (NCP) mg O_2 $m^{-2}d^{-1}$ (hr, month)	O_2 produced during the daylight period (sunrise-sunset) Final O_2 -Initial O_2 x CV^*x CF^{**}
Community Respiration (CR) mg O_2 $m^{-2}h^{-1}$ (day,month)	O_2 used by the community-day and night. $\dfrac{\text{Initial } O_2 - \text{Final } O_2 \times CV \times CF}{\text{run length (h)}}$
Gross Community Productivity (GCP) mg O_2 $m^{-2}d^{-1}$ (hr, month)	NCP + (CR/h^{-1} x Daylength)
Net Daily Metabolism (NDM) mg O_2 $m^{-2}d^{-1}$ (hr, month)	"profit or debit" GCP $m^{-2}d^{-1}$ - 24 hour CR $m^{-2}d^{-1}$
P/R Ratio	Photosynthesis/Respiration ratio GCP $m^{-2}d^{-1}$ / 24 hour CR $m^{-2}d^{-1}$
Ash Free Dry Weight (AFDW)	Organic content (g) of sample Ashed 550C (24 hours)
Epilithon AFDW	Organic content of inorganic sediment
Total AFDW	AFDW + Epilithon AFDW

* CV = chamber volume

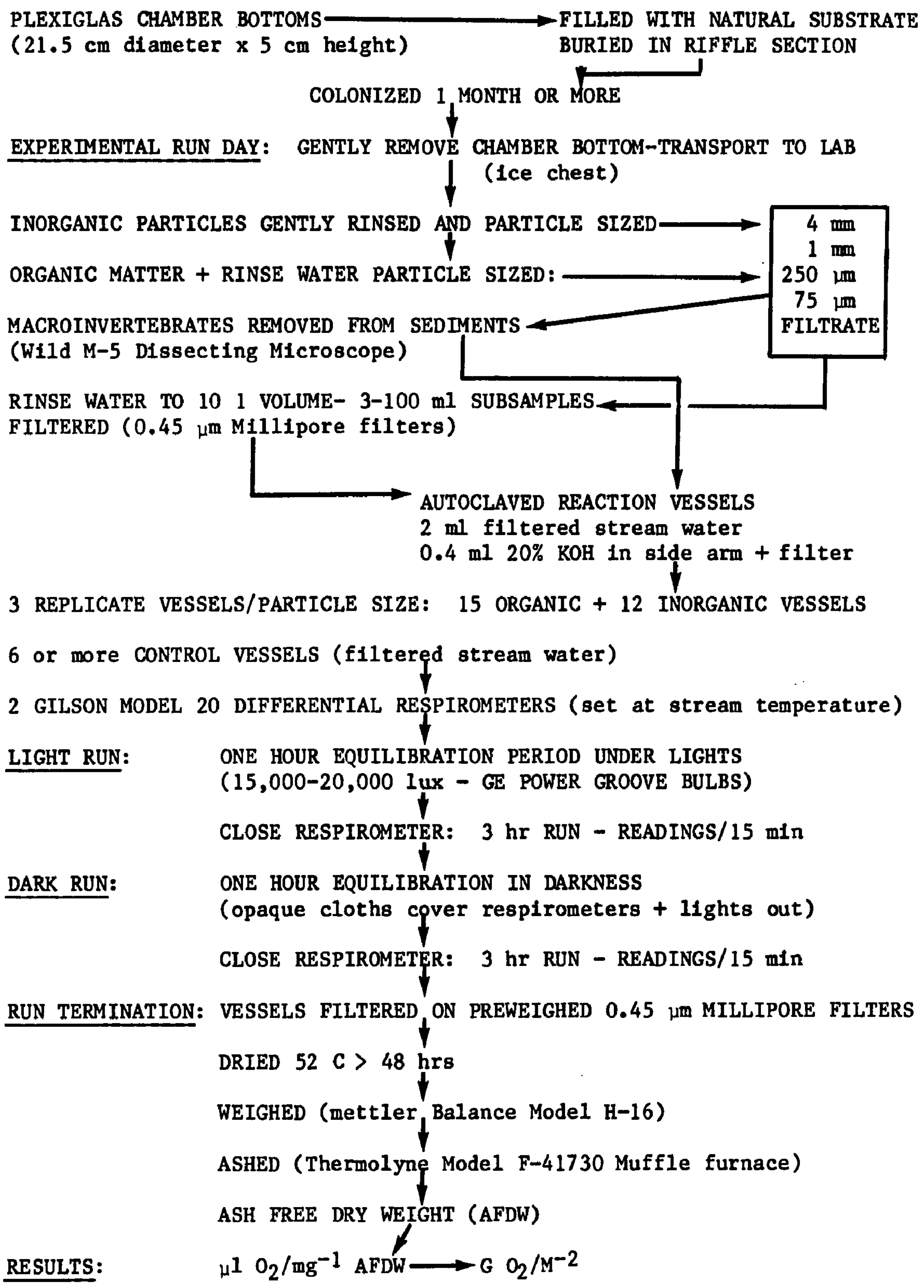
**CF = conversion factor to m^2

and AFDW, were completed (Biomedical Computer Programs P-Series (BMDP); Health Sciences Computing Facility, UCLA, NIH Special Research Resources Grant RR-3; Vax-11/780 digital computer, Kellogg Biological Station).

The contribution of the epilithon as well as the detrital flora of various sediment sizes to the NCP and CR during February - March, June and August at these five Augusta Creek sites (Figure 2), was determined using two Gilson Differential Respirometers (Model 20; Gilson 1963, Lawton and Richards 1970). Triplicate samples, picked macroinvertebrate free, of detritus and inorganic sediment particle-sized in 4 mm, 1 mm, 250 μm, 75 μm, and 0.45 μm categories, were run at the ambient stream temperatures under 15,000 lux (GE Power Groove bulbs) for estimates of NCP and in darkness for estimates of CR (Figure 9).

Samples were allowed to equilibrate under the lights for one hour prior to 15 minute estimates over a three hour period. The respirometers were then darkened for an equilibration period (1 hour), and a subsequent three hour dark estimates. All vessel contents were filtered on pre-weighed 0.45 μm Millipore filters, dried at 52 C, weighed, and ashed at 550 C for 24 hours for determination of AFDW (Figure 9). Estimates of NCP and CR were expressed as $\mu l\ O_2\ g\ AFDW^{-1}$ and $g\ O_2\ m^{-2}d^{-1}$ (G. L. Spengler modification of Petersen's 1974 respiration program; Hewlett-Packard 2100 A Mini Computer at the Kellogg Biological Station Computer Facility).

Figure 9. Experimental design for Gilson Respirometer estimates of community metabolism of particle-sized substrate.



PARTICLE SIZED COMMUNITY METABOLISM

PLEXIGLAS CHAMBER BOTTOMS → FILLED WITH NATURAL SUBSTRATE BURIED IN RIFFLE SECTION
(21.5 cm diameter x 5 cm height)

COLONIZED 1 MONTH OR MORE

EXPERIMENTAL RUN DAY: GENTLY REMOVE CHAMBER BOTTOM-TRANSPORT TO LAB
(ice chest)

INORGANIC PARTICLES GENTLY RINSED AND PARTICLE SIZED → 4 mm / 1 mm / 250 μm / 75 μm / FILTRATE

ORGANIC MATTER + RINSE WATER PARTICLE SIZED: → 4 mm / 1 mm / 250 μm / 75 μm / FILTRATE

MACROINVERTEBRATES REMOVED FROM SEDIMENTS
(Wild M-5 Dissecting Microscope)

RINSE WATER TO 10 l VOLUME- 3-100 ml SUBSAMPLES
FILTERED (0.45 μm Millipore filters)

AUTOCLAVED REACTION VESSELS
2 ml filtered stream water
0.4 ml 20% KOH in side arm + filter

3 REPLICATE VESSELS/PARTICLE SIZE: 15 ORGANIC + 12 INORGANIC VESSELS

6 or more CONTROL VESSELS (filtered stream water)

2 GILSON MODEL 20 DIFFERENTIAL RESPIROMETERS (set at stream temperature)

LIGHT RUN: ONE HOUR EQUILIBRATION PERIOD UNDER LIGHTS
(15,000-20,000 lux - GE POWER GROOVE BULBS)

CLOSE RESPIROMETER: 3 hr RUN - READINGS/15 min

DARK RUN: ONE HOUR EQUILIBRATION IN DARKNESS
(opaque cloths cover respirometers + lights out)

CLOSE RESPIROMETER: 3 hr RUN - READINGS/15 min

RUN TERMINATION: VESSELS FILTERED ON PREWEIGHED 0.45 μm MILLIPORE FILTERS

DRIED 52 C > 48 hrs

WEIGHED (mettler Balance Model H-16)

ASHED (Thermolyne Model F-41730 Muffle furnace)

ASH FREE DRY WEIGHT (AFDW)

RESULTS: μl O_2/mg^{-1} AFDW → G O_2/M^{-2}

Figure 9.

RESULTS AND DISCUSSION

Sunlight reflecting off Augusta Creek is jubilant in
early spring wherein lies a diatomaceous carpet...
March 1974

Physical Parameters

The range and average stream temperatures and incident light based on half-hour interval measurements at each site during the experimental runs, were used to characterize the conditions of metabolic estimates (Appendix D, Tables D 1-5).

Temperature

Based on weekly maximum-minimum temperature data from Augusta Creek sites (1973-1977; King 1978, Mahan 1980) temperature patterns were similar throughout the drainage with maxima ranging from 24.6 C at B Avenue to 29.6 C at Upper 43rd (Table 1). During this study similar trends were evident with maxima ranging from 19.9 C at B Avenue and Smith Sites to 24.8 C at Upper 43rd Site with Nagel and Kellogg Forest Sites attaining maxima of 23.9 and 22.2 C respectively (Appendix D).

Average daily temperatures exhibited typical temperate region seasonal trends at all sites (Figure 10). Mean daily temperatures ranged from 0.4 C at the Upper 43rd Site in January to 22.6 C at the Nagel Site in August. Maximum daily averages at the other sites were: Smith 17.6 C, B Avenue 17.6 C, Upper 43rd 21.7 C, and Kellogg Forest 19 C. Although large differences in temperatures were not evident, the first order Smith and B Avenue Sites had the lowest temperatures, the open Upper 43rd (second order) and Nagel (third order) the

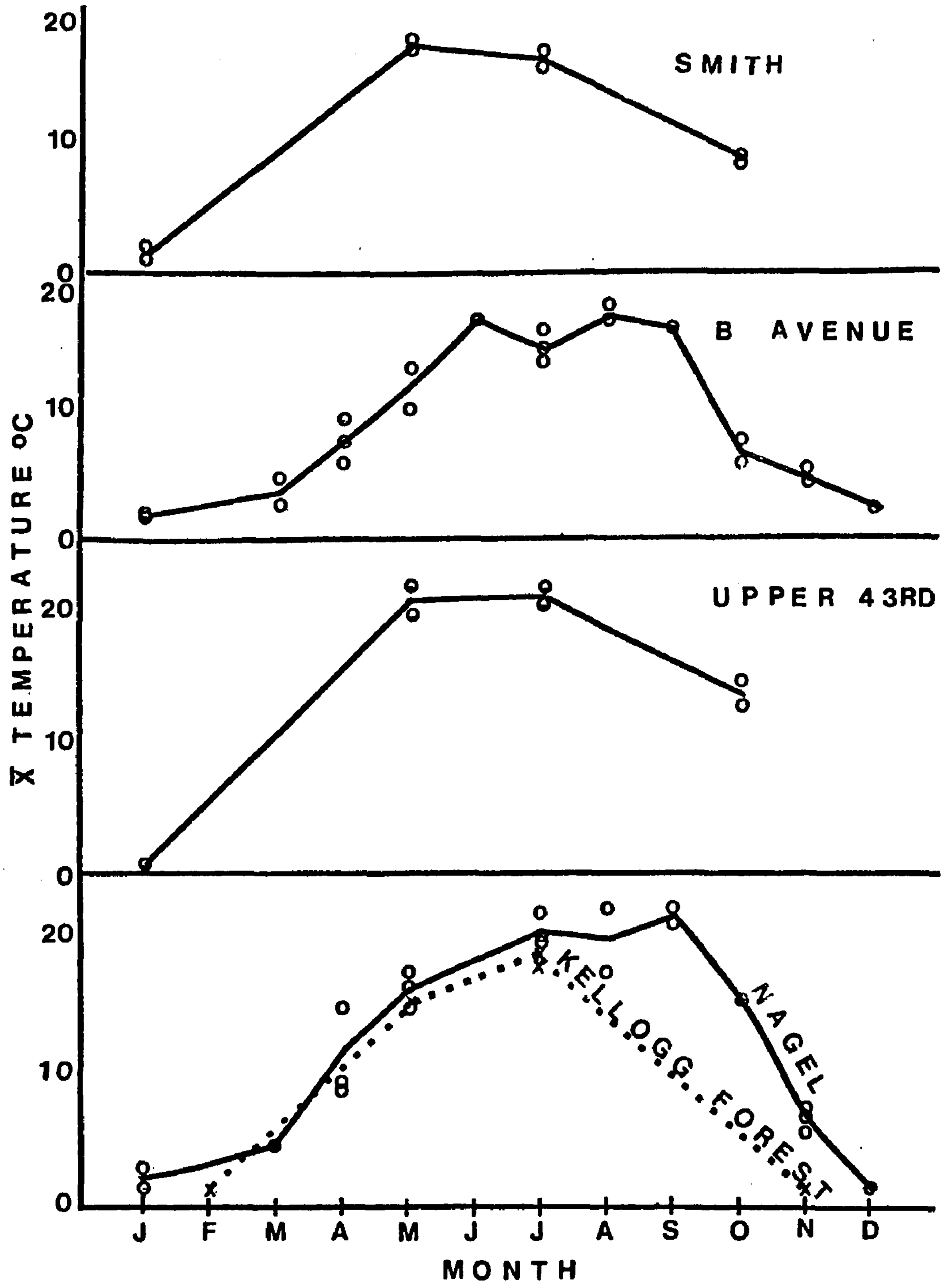


Figure 10. Average daily temperature values for selected sites in the Augusta Creek watershed, Kalamazoo County, Michigan (1973-1975).

highest, while those of the downstream forested third order Kellogg Forest Site were intermediate (Figure 10, Appendix D).

The greatest daily temperature fluctuations occurred in the first order sections during spring and summer (10.5 C) and were similar to fluctuations reported for an Arizona desert stream by Bush and Fisher (1981). However the greatest average daily fluctuations were at the Upper 43rd Site (4.0 C) followed by the Nagel Site (3.4 C) and indicated the influence of lack of canopy (Table 6). The lower Nagel average emphasized the presence of cold springs and perhaps increased volume at a third order reach (King 1978), while the stability of the Kellogg Forest temperatures probably represented increased discharge and shade effects. Since the metabolism experiments were run on a consecutive day basis such daily fluctuations were important. Consecutive day differences were significantly less than daily differences in range and average and varied from 27 to 50% of the average daily temperature fluctuations (Table 6).

Light (Irradiance)

Light (= irradiance) patterns at the five sites followed expected temperate region seasonal and site trends (Figures 11 and 12). Shading was indicated at the Smith, B Avenue, and Kellogg Forest Sites with maximum levels at the Upper 43rd and Nagel sites (Figures 11, 12; Table 7). The highest average daily light levels were recorded in May at the Upper 43rd Site (90,213 lux), and the Nagel Site (84,631 lux) and the lowest level was 2,391 lux during January at the B Avenue Site. The highest light levels were recorded at all sites during April, May and June, reflecting the approach of the summer solstice.

Table 6. Temperature fluctuations at sites of Augusta Creek, Kalamazoo County, Michigan (1973-1975).

Site	Daily Range °C	Daily Average °C	Consecutive Day Range °C	Consecutive Day Average °C	Percent of Daily
Smith*	0.5-7.1	3.0	0.4-1.5	0.9	30
B Avenue	0.3-10.5	3.3	0.1-3.0	1.1	33
Upper 43rd*	0.5-7.2	4.0	0.5-2.7	1.7	42
Nagel	0.0-6.0	3.4	0.0-5.2	1.7	50
Kellogg Forest*	0.0-5.8	2.6	0.1-1.2	0.7	27

* Seasonal estimates only (1974-1975)

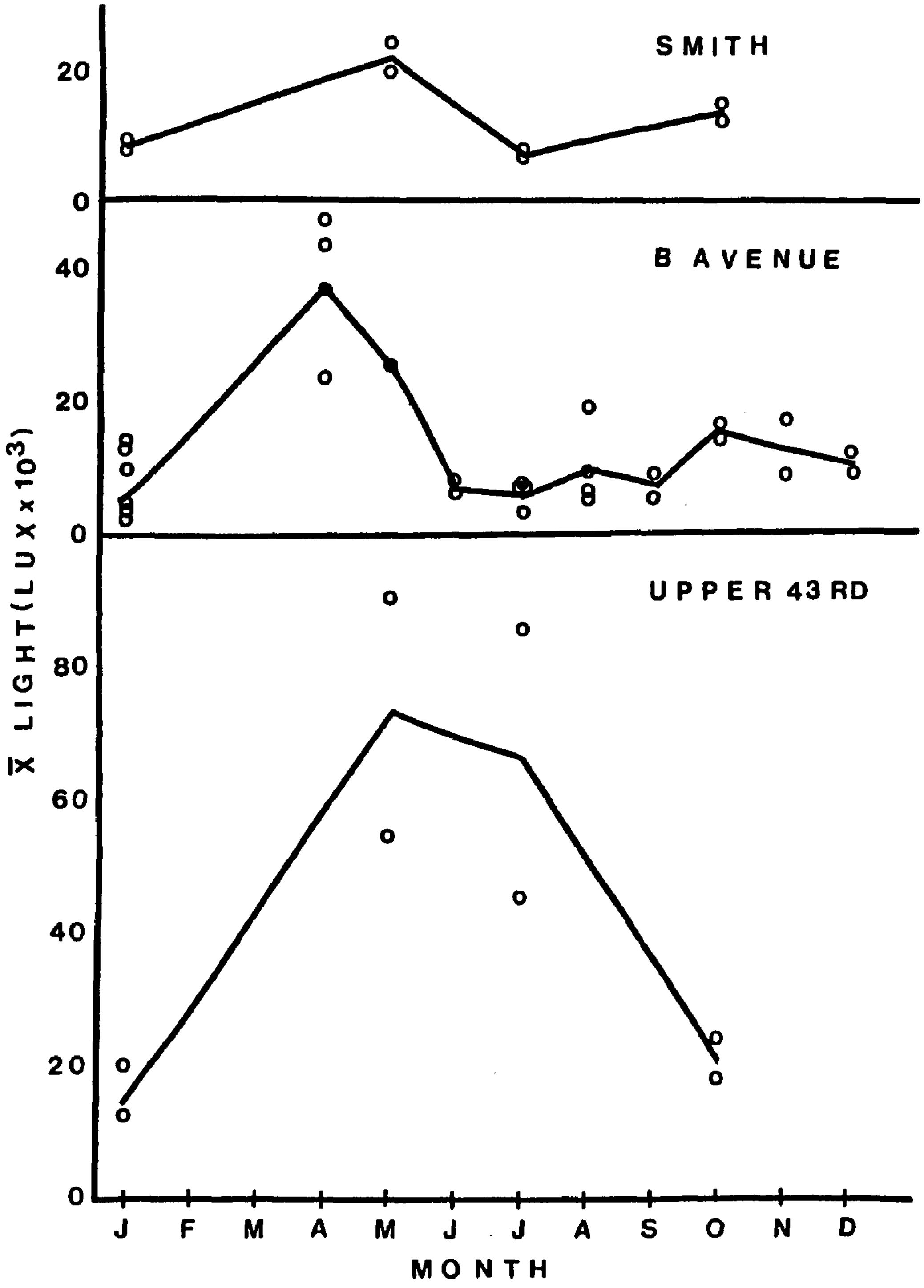


Figure 11. Average daily light values for the Smith, B Avenue, and Upper 43 Rd sites of Augusta Creek, Kalamazoo County, Michigan (1973-1975).

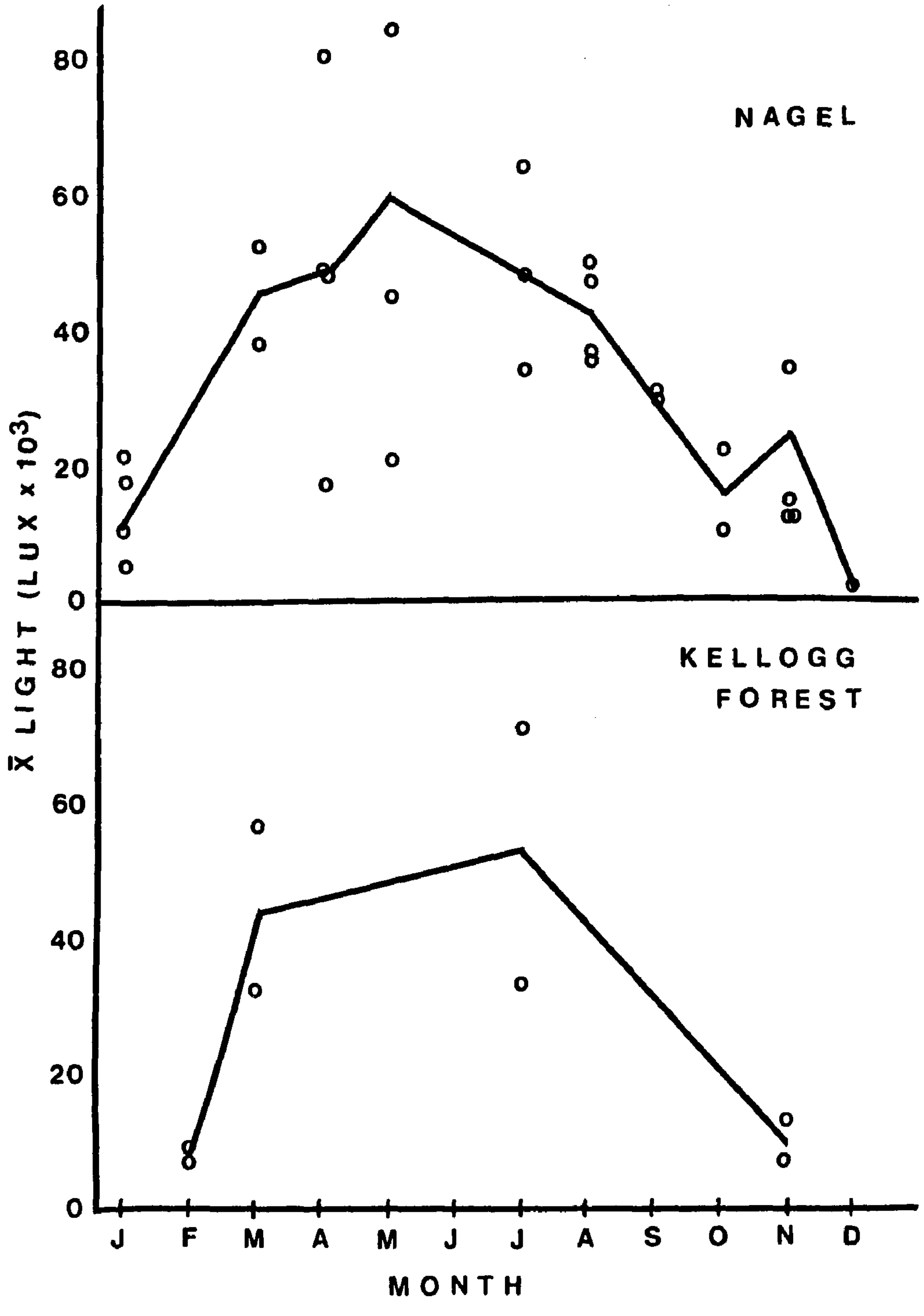


Figure 12. Average daily light values for Nagel and Kellogg Forest Sites of Augusta Creek, Kalamazoo County, Michigan (1973-1975).

Table 7. Light intensity fluctuations (irradiance) at selected sites of Augusta Creek, Kalamazoo County, Michigan (1973-1975).

Site	Daily Average (Lux)	Annual Fluctuations Daily Average (Lux)	Percent Maximum Lux	Percent Kellogg Forest Lux
Smith*	12,054	6,268-23,358	28	42
B Avenue	13,213	2,391-47,709	30	46
Upper 43rd*	43,622**	12,208-90,213	100	152
Nagel	36,959	2,824-84,631	85	128
Kellogg Forest*	28,787	6,404-71,840	66	100

* Seasonal data only

** Maximum

Leaf emergence at the shaded sites significantly decreased light levels in June, while abscission increased light in October when incident light is on a gradual decline in the temperate latitudes (Figures 11 and 12). Lower light values at Smith and B Avenue, even during periods when leaves were not present, indicated the shading effect by tree "skeletons".

The annual patterns of average daily lux indicated positive relationships with stream cover and width. Narrow first order reaches had mimimum light, wider unforested reaches had maximum and the 7.0 m shaded Kellogg Forest reach intermediate levels (Figures 3, 4; Table 7). Autotrophic zones, according to the continuum concept, generally will be limited in natural stream reaches of 10 m or less in width (Vannote et al. 1980). Because of canopy alteration at the second order Upper 43rd and third order Nagel Sites, significant light inputs resulted. As well, significant levels occurred at the forested Kellogg Forest Site (66% of the open sites; Table 7).

The percentage of maximum daily light (Upper 43rd) received by each site ranged from 25 to 85% at the Smith and Nagel sites, respectively (Table 7). If the Kellogg Forest is considered a typical shaded third order reach the first order sites received 42 to 46% of maximum light in contrast to 28 to 30% of the open site (Table 7). The difference in light at the two open sites may be accounted for by the orientation of the channel (Upper 43rd E-W and Nagel N-S), as shown by Kobayasi (1961) for a canyon stream; variability in days monitored; or the increased observations at the Nagel Site (n = 8 Upper 43rd, n = 30 Nagel).

The complexity of the light regime at the shaded Kellogg Forest

Site, represented in Figure 13, illustrated the predictable variation in potential autotrophic zones during leaf-out of riparian vegetation and reflected the heterogeneity with which one must contend in estimating *in situ* metabolic activity, hopefully, viewed as a challenge rather than a deterrent to *in situ* measurements.

Community Metabolism

The interrelationships of autotrophic and heterotrophic components within lotic communities has been of interest for some time. Only recently, concomitant with this investigation and the advent of field chamber techniques, have estimates of community metabolism been made on discrete communities (Bombowna 1972, Pfeifer and McDiffett 1975, Marker 1976b, Bott et al. 1978, Pennak and Lavelle 1979, Sumner and Fisher 1979, Bush and Fisher 1981, Hornick et al. 1981). Such studies allow analyses of the producing or consuming modes of the community and thus, the autotrophic-heterotrophic balance within. Community metabolism studies have followed the approach for studying lotic systems outlined by Shelford and Eddy (1929) with several excellent artificial stream and laboratory chamber studies completed prior to *in situ* work (Whitford and Schumacher 1961, 1964; Edwards and Rolley 1965; Kevern and Ball 1965; McIntire and Phinney 1965; McIntire 1966; Maki 1974; Pfeifer and McDiffett 1975).

Methods and standardization of data presentation for studies of community metabolism are still in a state of flux. Many methods have been presented, however, often no mention is made of what was measured (i.e. gross versus net community productivity); standardization of units (oxygen, carbon, calories, gram calories, chlorophyll (various

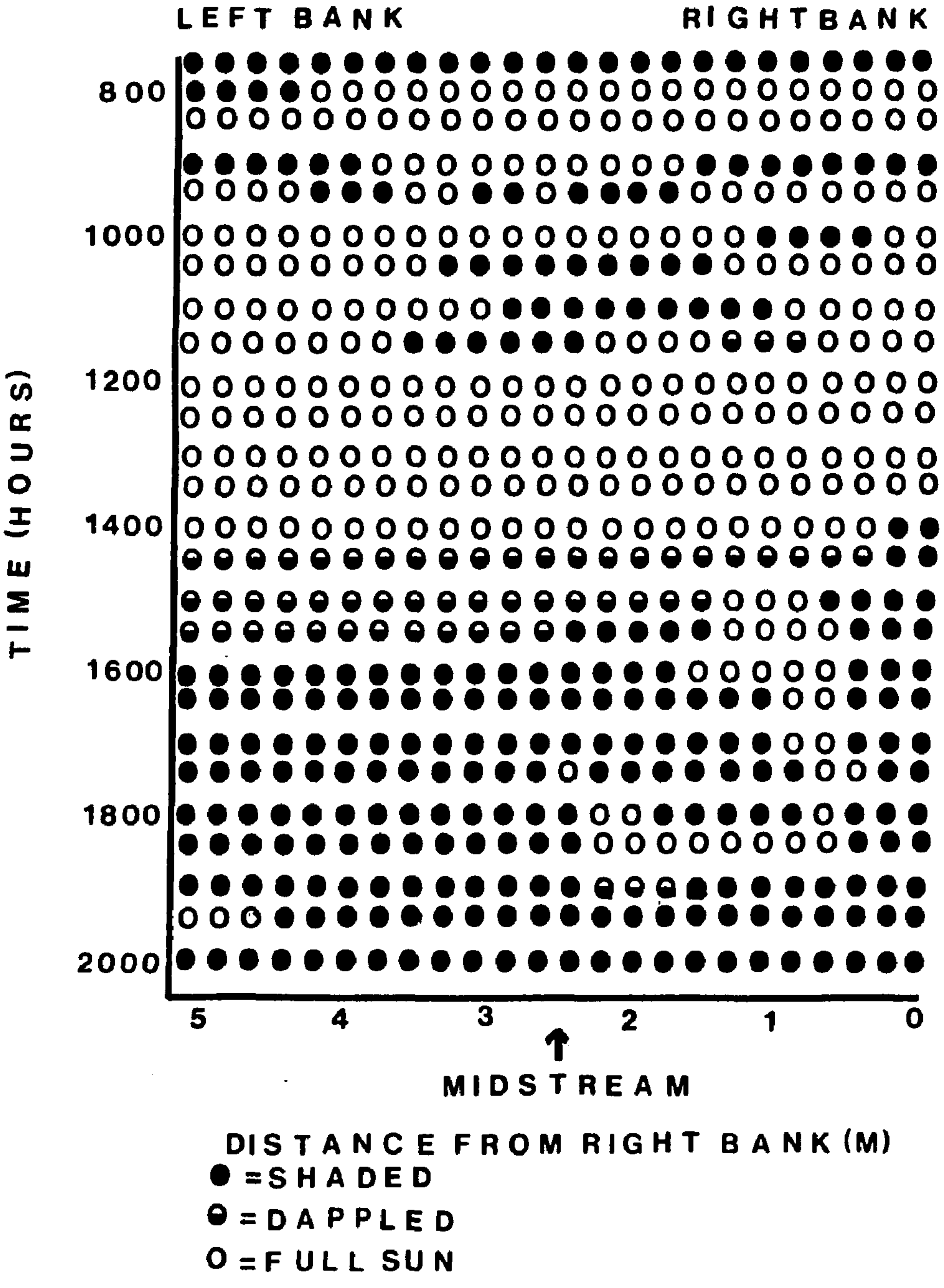


Figure 13. Daily light patterns at Kellogg Forest, Augusta Creek, Kalamazoo County, Michigan on 25 July 1975.

pigments or total), glucose, dry weight, AFDW); or how the results are expressed (m^{-2}, m^{-3}, mg^{-1}chlorophyll, g^{-1} dry weight, g^{-1} AFDW, per chamber, etc.). Various estimates of PQ (photosynthetic quotient) and RQ (respiratory quotient) also complicate the situation of converting oxygen values to carbon and based on the few studies completed on periphyton communities, these quotients appear to be highly variable (PQ 1.45 to 2.6, RQ 0.85 to 1.1; Schindler et al. 1973, Bott et al 1978, Bott and Ritter 1981). Oxygen and ^{14}C estimates of community metabolism have been shown to measure similar magnitudes of productivity in coral reef communities (Littler 1973) and littoral zones of freshwater lakes (Hunding and Hargrave 1973); yet Schindler et al. (1973) compared four methods (oxygen, dissolved inorganic carbon, ^{14}C uptake and disappearance) and found little agreement other than general trends. They attributed the discrepancies to inappropriate PQ and RQ values for the gaseous methods. Bott and Ritter (1981) compared ^{14}C and oxygen estimates of community productivity in riffle communities and reported similar patterns of productivity, but lower estimates were obtained using the ^{14}C method; PQ values varied, which reinforced the necessity of measuring PQ, as values were generally higher than previously reported.

Since the conversion of oxygen uptake to carbon fixation is not reliable, data from this investigation will be presented, as measured, as oxygen and compared with those studies reported in oxygen units. (Table 8). This study, based on intact riffle communities and not isolated substrates, should yield a more realistic estimate of *in situ* metabolism of riffle reaches in Augusta Creek.

Table 8. Literature estimates of *in situ* community metabolism in streams (g O_2 $m^{-2}d^{-1}$).

Author/s	Date	System	Period	NCP*	CR	GCP	P/R
CHAMBER ESTIMATES							
Göthberg & Karlström	1975	Rickleån River-N,H Sweden	Fall & Summer	------	0.5-0.7	-----	------
Marker	1976	Bere Stream England	Annual	------	0.3-7.2	-----	------
Bott et al.	1978	White Clay Creek-N-3 Pennsylvania	August	0.7-3.5	0.7-3.1	1.5-7.1	0.94-1.05
Litke	1978	Chippewa River-N-4 Michigan	Seasonal	------	0.5-2.4	0.8-4.6	1.4-1.8
Sumner & Fisher	1979	Fort River-N-3 Massachusetts	Annual	------	1.5-7.0	0.1-6.5	0.01-0.68
Bush & Fisher	1981	Sycamore Creek-CM Arizona	Summer	------	5.1	4.4-12.5	0.96-2.3
LIGHT BOTTLE-DARK BOTTLE							
Bombówna	1972	River Raba-N-2 Poland	April-October	------	------	0.96-1.32	------
Ertl & Tomajka	1973	Danube River	Annual	------	------	0.9-0.55	------

Table 8. (cont'd.)

Author/s	Date	System	Period	NCP*	CR	GCP	P/R
LIGHT BOTTLE-DARK BOTTLE (Cont'd.)							
Helan et al.	1973	Brodská Brook-N Czechoslavakia	June-March	------	------	0.13-11.34	------
UPSTREAM-DOWNSTREAM METHOD							
Butcher et al.	1930	Itchen River-N England	Nov.-March	------	4.2-20.2	0.04-14.0	0.1-1.1
Butcher et al.	1930	Lark River-P England	Nov.-May	------	35.0-53.0	0.53-0.39	0.01-1.1
Denham	1938	White River-E Indiana	Annual	------	5.8-18.6	5.5-14.0	0.6-1.1
Hornuff**	1957	Blue River Oklahoma	------	------	------	1.03	------
Hornuff	1957	Mountain Fork Oklahoma	------	------	------	2.17	------
Hornuff	1957	Honey Creek Oklahoma	------	------	------	2.66	------
Hoskin	1959	Neuse River North Carolina	------	------	------	------	0.2-0.7

Table 8. (cont'd.)

Author/s	Date	System	Period	NCP*	CR	GCP	P/R
<u>UPSTREAM-DOWNSTREAM (Cont'd.)</u>							
Nelson and Scott	1962	Piedomont Stream-N,T Georgia	Aug.-Dec.	------	0.43-2.55	0.7-0.27	0.16-0.26
Noyce***	1965	Cottonwood River Kansas	------	------	0.6-9.6	1.5-7.0	------
Baumgardner***	1966	Skeleton Creek-P Oklahoma	------	------	0.6-9.6	1.5-7.0	------
Duffer & Dorris	1966	Blue River-N-2 Oklahoma	June-August	------	6.1-19.9	1.5-48.0	------
Hannan****	1967	San Marcos River-N,M Texas	------	------	4.1-19.9	2.5-27.4	------
Stockner	1968	Ohanapecosh-N,H Washington	------	0.33-8.64	0.56-2.7	0.89-11.3	1.1-5.0
Eley***	1970	Skeleton Creek Pennsylvania	Annual	------	33.5	13.6	------
Flemer	1970	Roritan River-N 4-5 New Jersey	May-Sept.	------	3.7-5.4	2.0-8.8	0.8-1.6
Flemer	1970	Roritan River-E 4-5 New Jersey	Oct.-Dec.	------	0.9-1.9	2.5-16.7	0.9-1.9

Table 8. (cont'd.)

Author/s	Date	System	Period	NCP*	CR	GCP	P/R
UPSTREAM-DOWNSTREAM (Cont'd.)							
Flemer	1970	Roritan River-E 4-5 New Jersey	Oct.-Dec.	------	7.0-11.3	2.5-25.1	0.7-2.0
Hall	1972	New Hope-N N. Carolina	2 years	------	0.4-13.0	0.21-9.0	------
McDiffett, Carr & Young	1972	Buffalo Creek-N Pennsylvania	August	------	2.0-2.3	4.9-6.3	2.6
Cole	1973	Spring Creek-N Pennsylvania	Annual	------	2.0-13.0	2.0-17.0	0.3-2.0
Cole	1973	Spring Creek-E Pennsylvania	Annual	------	12.0-18.0	4.0-20.0	0.2-0.9
Profet & Ransom	1974	Cedar Creek-N Kansas	Summer	------	5.52-26.6	1.0-24.2	------
Profet & Ransom	1974	Cottonwood River-N-4 Kansas	Summer	------	19.9-26.4	9.9-32.3	------
Profet & Ransom	1974	Walnut River-N Kansas	Summer	------	7.2-12.0	5.1-5.7	------
de la Cruz & Post	1977	Catahoula River-N-2 Mississippi	Seasonal	------	7.88-50.1	4.1-28.4	0.24-0.57

Table 8. (cont'd.)

Author/s	Date	System	Period	NCP*	CR	GCP	P/R
UPSTREAM-DOWNSTREAM (Cont'd.)							
Gelroth & Marzolf	1978	Lost Creek-N-2 Kansas	July	------	0.54-1.88	0.51-1.21	0.64-0.95
Gelroth & Marzolf	1978	Lost Creek-C-2 Kansas	July	------	2.11	4.16	1.97

* = All values g O_2 $m^{-2}d^{-1}$ except P/R. All studies used oxygen techniques.

** = Classification of system: N = Natural-Order, Order approximated from information in study;
P = Polluted; E = Effluent; M = Macrophyte dominated; T = Turbid;
H = Hot Spring; C = Channelized; CM = *Cladophora* mat; H = Headwater.

*** = Taken from Profet and Ransom, 1974.

**** = Taken from Mathis, Taylor and Myers, 1969.

Gross Community Productivity

GCP, the most cited parameter in the productivity literature, indicates the maximum carbon producing capacity of the autotrophic community and is estimated by the addition of NCP plus CR for the photo-period. Much of the GCP may in turn be respired by the autotrophs. Verduin (1956) noted that the autotrophic community respired up to 80% of the GPP in phytoplankton studies while Hargrave (1969) and Hunding (1971) reported 13 to 15% of GCP respired by periphytic algae. In the present study NCP and CR were obtained from the same sediment on consecutive days, therefore it was assumed that similar heterotroph respiration rates were involved in both NCP and CR estimates.

Intrasite seasonal and intersite variations in GCP occurred annually at riffle sites of Augusta Creek (Figure 14). The lowest GCP values were recorded for the first order sections (Smith 0.09 to 0.18 g O_2 $m^{-2}d^{-1}$ and B Avenue 0.01 to 0.59 g O_2 $m^{-2}d^{-1}$), the open Nagel and Upper 43rd were highest (0.53 to 5.35 and 0.34 to 3.25 g O_2 $m^{-2}d^{-1}$ respectively), and the shaded third order Kellogg Forest reach was intermediate (0.53 to 2.16 g O_2 $m^{-2}d^{-1}$; Figure 14; Appendices A, B). On an annual average basis they ranked from lowest to highest: Smith, B Avenue, Kellogg Forest, Upper 43rd, and Nagel (Table 9).

Odum (1956) stated that streams may well be among the most productive environments on earth. However, his statement was based on standing crop estimates and ecosystem studies, using the upstream-downstream oxygen method for estimating productivity, in streams often enriched by organic pollution. Literature GCP values using the

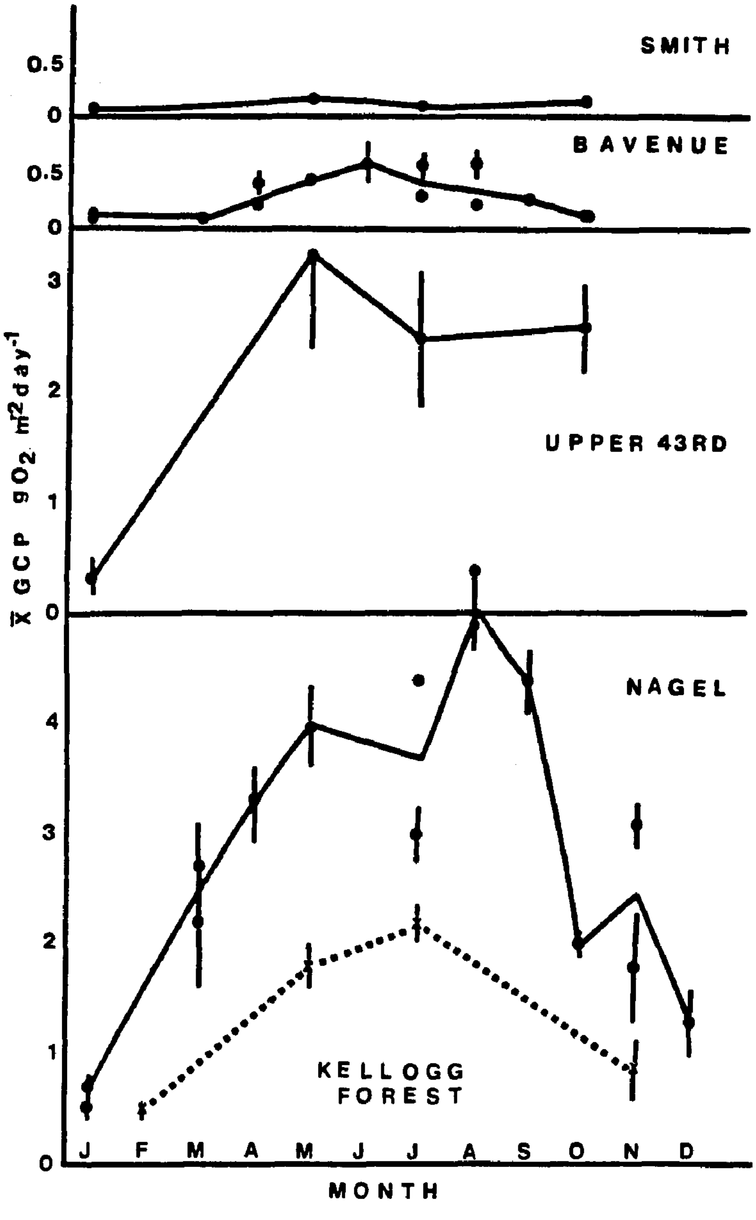


Figure 14. Average GCP (± SE) estimates for selected riffle communities in the Augusta Creek watershed, Kalamazoo County, Michigan (1973-1975).

Table 9. Average community metabolism parameters for experimental runs completed at five riffle sites of Augusta Creek, Kalamazoo County, Michigan 1973-1975.

Site	$\bar{X}$ NCP g $m^{-2}d^{-1}$	$\bar{X}$ CR g $m^{-2}d^{-1}$	$\bar{X}$ GCP g $m^{-2}d^{-1}$	$\bar{X}$ NDM g $m^{-2}d^{-1}$	$\bar{X}$ P/R	$\bar{X}$ DETRITUS gAFDW m^{-2}	$\bar{X}$ EPILITHON gAFDW m^{-2}	$\bar{X}$ TOTAL gAFDW m^{-2}
Smith	-0.16	0.56	0.13	-0.44	0.21	388.2	1763.2	2151.8
N	4	4	4	4	4	4	4	4
S.E.	0.05	0.10	0.02	0.10	0.03	49.4	161.2	202.2
C.V.%	56.3	35.3	30.7	46.1	26.9	25.5	18.3	18.3
B Avenue	-0.02	0.53	0.26	-0.26	0.45	290.4	2306.8	2625.5
N	16	16	16	16	16	14	4	4
S.E.	0.02	0.06	0.05	0.03	0.06	36.7	191.0	204.1
C.V.%	476.5	43.7	73.7	50.9	53.1	47.4	16.6	15.5
Upper 43rd	1.24	1.79	2.18	0.45	1.20	240.1	3558.5	3503.5
N	4	4	4	4	4	4	4	4
S.E.	0.40	0.49	0.63	0.31	0.17	31.5	702.5	417.9
C.V.%	64.0	54.3	58.1	134.9	27.9	26.3	43.1	41.0
Nagel	1.80	1.88	2.89	1.01	1.57	291.1	3507.5	3850.5
N	15	15	15	15	15	14	4	4
S.E.	0.26	0.26	0.40	0.24	0.12	17.3	658.5	671.2
C.V.%	56.0	53.6	52.9	91.0	29.1	22.3	37.6	34.9
Kellogg Forest	0.94	0.75	1.36	0.60	1.97	282.5	2675.0	2957.0
N	4	4	4	4	4	4	4	4
S.E.	0.23	0.25	0.38	0.17	0.15	28.9	378.0	350.5
C.V.%	48.8	65.4	55.0	56.0	55.4	20.5	28.3	23.7

upstream-downstream method (Odum 1956) range from 0.51 g O_2 $m^{-2}d^{-1}$ in a natural second order creek of the prairie biome in Kansas (Gelroth and Marzolf 1978) to 48.0 g O_2 $m^{-2}d^{-1}$ in Blue River Oklahoma (Duffer and Dorris 1966; Table 8). Chamber and light-dark bottle estimates ranged from 0.09 g O_2 $m^{-2}d^{-1}$ on revetments of the Danube River (Ertl and Tomajka 1973) to 12.5 g O_2 $m^{-2}d^{-1}$ in Cladophora mats of Sycamore Creek, Arizona (Bush and Fisher 1981). Chamber techniques have been developed to monitor rates of community metabolism in environments with low productivity and in riffle sections where more sensitive methods are essential. The rates of GCP from riffle communities in Augusta Creek ranged from 0.09 to 0.59 g O_2 $m^{-2}d^{-1}$ at the shaded Smith Site to the open Nagel Site, respectively. These rates are in the lower range of those reported for lotic communities (Table 8). Annual rates at the Smith and B Avenue sites are the lowest in situ measurements reported to date (Table 9; Appendix A). The Augusta Creek GCP maxima are similar to GPP rates of phytoplankton communities while the range is equivilent to terrestrial levels of GPP reported for deserts to temperate deciduous forests (Wetzel 1975a).

The narrow, shaded Smith Site had the lowest seasonal GCP values (Figure 14; Table 9). Although, on a qualitative basis algae were never obvious at the Smith Site, maximum GCP rates were recorded in May prior to leaf emergence, which was during the period of visual diatom bloom in the rest of the watershed.

The B Avenue site also exhibited low levels of GCP on an annual basis, but averaged twice those at Smith Site (Figure 14; Table 9). Maximum rates were measured in June, but within the range of variation rates were similar from April through October. Algal growth was never obvious in the shaded reaches at B Avenue, but microscopic examination revealed a diverse array of pennate diatoms during the summer months. Annual rates of GCP at this site were similar to those obtained by Nelson and Scott in a 60-m wide piedmont stream in Georgia (1962); they attributed their low values to the presence of high silt loads limiting light penetration (Table 8).

The differences in average daily light received by the two first order Augusta Creek study sites was probably insignificant, as both sites were heavily shaded (Figure 3). The averages for the June to October period were 9,055 lux (n=4) and 8,512 (n=15) at Smith and B Avenue, respectively. Estimates of light-saturated photosynthetic rates in periphyton communities range from 8,000 to 62,000 lux (Kobayasi 1961, McIntire et al. 1974, McIntire and Phinney 1965, Adams and Stone 1973, Lester et al. 1974). The averages for Smith and B Avenue Sites indicated potential shading effects with frequently less than light-saturated photoperiods (Appendix D). CR rates were similar at both sites; but, Smith had slightly higher CR rates (0.56 g O_2 $m^{-2}d^{-1}$) compared to B Avenue (0.53 g O_2 $m^{-2}d^{-1}$), therefore, higher estimates of GCP would tend to be at the Smith Site. Greater GCP at the B Avenue site was probably due to increased algal photosynthesis rather than an effect of CR rates.

The Upper 43rd and Nagel Sites were approximately 13 times more productive than the first order reaches (Figure 14). They also received much higher average light inputs (43,622 lux Upper 43rd and 36,959 lux Nagel) and exhibited a definite succession of attached algae. During the spring, diatom blooms, often nearly pure populations of <u>Meridion circulare</u> Agardh, carpeted all available substrates. Diatoms were followed in late spring by patches of epipsammic Vaucheria, followed by a patchy summer distribution of Cladophora and blue-green mats dominated by Oscillatoria. A second pulse of diatoms, a mixed association of pennate forms, developed in autumn.

At Upper 43rd the rates of GCP increased in May, remained high throughout the summer and fall, and then decreased significantly during winter. Based on chamber estimates from larger order riffle communities (Table 8), the rates of GCP for Upper 43rd Site (0.34 to 3.25 g O_2 $m^{-2}d^{-1}$ were higher than anticipated for a second order reach. By comparison, in a natural shaded second order section of Lost Creek, Kansas, Gelroth and Marzolf (1978) reported rates of 0.51 to 1.21 g O_2 $m^{-2}d^{-1}$, while in a cleared and channelized section rates of GCP rose to 4.16 g O_2 $m^{-2}d^{-1}$, similar to maxima for the Upper 43rd reach.

The third order Nagel Site followed the same seasonal trend as Upper 43rd, but maximum productivity was measured during August (Figure 14) and represented the highest GCP values recorded. These high Augusta Creek rates are similar to those reported by authors using the upstream-downstream technique in various systems (Table 8) and chamber techniques on an open third order stretch of White Clay Creek, Pennsylvania (Bott et al. 1978). The range of 0.66 to 5.35 g O_2 $m^{-2}d^{-1}$ obtained for Nagel Site was similar to the chamber GCP estimates of Marker (1976b), Litke (1978), and Sumner and Fisher (1979) (Table 8). Based on these comparisons, canopy removal at the Nagel Site shifted the position of this site in the theoretical continuum (Vannote et al. 1980) to reflect the primary productivity of a naturally more open fourth order reach.

The shaded third order Kellogg Forest site averaged 47% the GCP of the cleared Nagel site (1.3 g O_2 $m^{-2}d^{-1}$). An increase in spring plateaued to summer values, then decreased during the fall and winter (Figure 14; Appendix A). The range of 0.53 to 2.16 g O_2 $m^{-2}d^{-1}$ over the annual period was within the range of studies cited in Table 8. Both maximum and minimum values were lower than those obtained at the cleared Nagel Site and from a naturally shaded fourth order Chippewa River, Michigan, riffle section (Litke 1978). Average light at the Kellogg Forest Site was 66% that of the open reaches (Table 7) with patchy algal development that was never as obvious as at the open Nagel Site. Similar differences in shaded versus unshaded reaches of the same order have been reported by Gelroth and Marzolf (1978), Gregory (1980), Hornick et al. (1981).

Maximum levels of GCP occurred during May and June at Smith, B Avenue and Upper 43rd Sites, while the Kellogg Forest maximum was in July, and Nagel in August (Figure 14). Seasonal trends such as these are typical of aquatic systems of the temperate region (Teal 1957, Cushing 1967, Stockner 1968, Hargrave 1969a, Flemer 1970, Gargas 1970, Hunding 1971, Hall 1972, Vannote and Ball 1972, Helan et al. 1973, Schindler 1973, Profet and Ransom 1974, Marker 1976b, de laCruz and Post 1977, Gelroth and Marzolf 1978, Sumner and Fisher 1979, Hornick et al 1981). The lowest GCP occurred during the winter at all sites of Augusta Creek, a pattern also characteristic of studies in which GCP was monitored on an annual basis (Cushing 1967, Stockner 1968, Ertl and Tomajka 1973, Marker 1976b, Sumner and Fisher 1979).

Viewing natural streams as a continuum (Vannote et al. 1980), the hypothetical Augusta Creek site ranking based on levels of GCP would proceed from headwater downstream (Smith, B Avenue, Upper 43rd, Nagel, Kellogg Forest). Based on increasing in situ estimates of GCP they were: Smith, B Avenue, Kellogg Forest, Upper 43rd, and Nagel (Table 9). The open Upper 43rd and Nagel Sites illustrated the effects of perturbation by man, while the more natural state of a third order reach was shown by the Kellogg Forest results. The occurrence of open areas increases the complexity of community metabolism patterns in temperate woodland stream riffle sections. Natural and man-produced open areas are typical of present day stream systems and must be considered in applying the continuum concept. Such discontinuities in the continuum are treated in the intermediate disturbance hypothesis of Ward and Stanford (1981).

Net Community Productivity

Net community productivity (NCP), defined as the rate of carbon reduction minus usage in community respiration during the photoperiod, can be measured directly as oxygen gain or loss using the oxygen change technique. Radioactive carbon tracer uptake experiments (^{14}C) approximate NCP rates (Vollenweider 1969, APHA et al 1971, Schindler et al. 1973, Hunding and Hargrave 1973, Matheke and Horner 1974, Bott and Ritter 1981). NCP is of interest from an ecological standpoint since it represents the carbon available for use, storage, or export within a community. Likens (1975) points out that this is the commodity of interest to consumers and would therefore be important in community and ecosystem modeling. Pratt and Burkson (1959) stated that carbon produced in excess of metabolic need is equivalent to that quantity that can be exported without change in community standing crop. The majority of work on primary productivity in lotic systems has been orientated towards quantitative or distributional studies (GCP) or laboratory experiments examining effects of physical parameters on rates of primary productivity. Few estimates of NCP exist in the literature (Grzenda et al. 1968, Stockner 1968, Hunding 1971, Adams and Stone 1973, Littler 1973, Cadee and Hegeman 1974, Bott et al. 1978, Bott and Ritter 1981) and not all of these cited are from lotic systems.

Estimates of NCP at the five Augusta Creek sites ranged from a miximum of 4.02 g O_2 $m^{-2}d^{-1}$ at the Nagel Site in August to a low of -0.25 g O_2 $m^{-2}d^{-1}$ at the Smith Site in October (Figure 15; Appendices A, B). Ranked in increasing order of average NCP $m^{-2}d^{-1}$ the sites were in the same order as for GCP (Table 9; Figure 14).

Although photosynthesis was taking place at the first order sites, as indicated by the positive annual GCP values, the NCP was zero or less with the strongest negative trend at the Smith Site (Figures 14, 15; Table 9). Dependence of headwater streams on detrital input from the watershed with primary production often responsible for less than one percent of the annual carbon budget has been shown by Minshall (1967), Kaushik and Hynes (1968), Coffman et al. (1971), Fisher and Likens (1973), Sedell et al. (1975), and Bell et al. (1978). The low rates of NCP coupled with the higher detrital standing crops found at the Augusta Creek first order sites indicated a dependence on allochthonous carbon (Table 9). As discussed for GCP, average light inputs on an annual basis and especially during periods of leaf-out, were undoubtedly limiting the autotrophic potential at

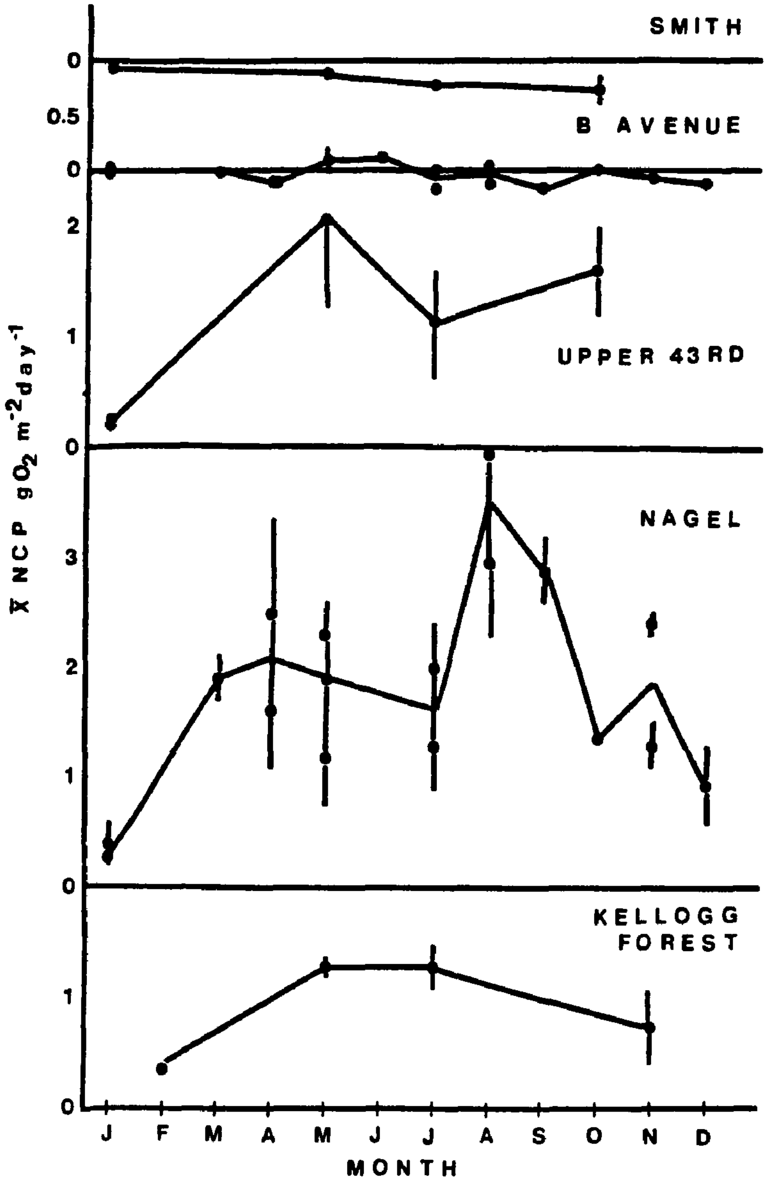


Figure 15. Average rates (+ SE) of NCP at selected riffle sites in the Augusta Creek watershed, Kalamazoo County, Michigan (1973-1975.

these sites (Table 7; Appendix D).

In addition to light limitation, grazing may also have accounted for the lowered levels of NCP at Smith and B Avenue Sites. Hargrave (1969a, 1972) reported low production in the littoral sediments of Lake Marion and Lake Esrom which he attributed to grazing. Kesler (1981), documenting significant grazing effects on attached algae, reported grazing pressures by the midge Corynoneura scutellata to account for 3 to 70% of the NCP. Populations of the scraper caddisfly Glossosoma nigor were abundant at the B Avenue site, and occurred at lesser densities at all other locations, therefore, one might speculate that they were influential in reducing the standing crop of algae and NCP.

The open Upper 43rd and Nagel sites had the highest autotrophic potential of the Augusta Creek sites studied with no significant difference in NCP evident between sites (Figure 15; Table 9). Summer rates measured at Upper 43rd and Nagel sites were similar to those reported by Bott et al. (1978) for an open third order reach of White Clay Creek, Pennsylvania.

NCP at the Kellogg Forest Site was significantly lower than the Nagel reach, but similar to Upper 43rd in average NCP (Table 9). The major divergence was notable during the summer leaf-out period (Figure 15). During this period the average light at the Kellogg Forest was 3,493 lux d^{-1}, similar to January levels at this site (Appendix D), and well below light saturation levels of periphyton communities (8,000 to 62,000 lux).

It has been estimated that in aquatic communities 15 to 80% of the GCP may be respired by the in place community (Verduin 1956, Hargrave 1969a, Hunding 1971), which leaves a net gain of 20 to 85% as NCP. The average NCP as a percent of average GCP for Augusta Creek sites was highly variable: -128.5% Smith, -7.6% B Avenue, 57% Upper 43rd, 60% Nagel, 69% Kellogg Forest. The shaded first order sites with negative average deficits are unique to the primary productivity literature, while the open sites (Upper 43rd and Nagel) and shaded third order (Kellogg Forest) site, averaging 62% NCP, were similar to the estimated range in the literature. This again illustrates the dependence on allochthonous carbon sources and the heterotrophic nature of shaded first order Augusta Creek sites and obvious shifts in the magnitude of NCP due to clearing illustrated by the comparison of the Nagel and Kellogg Forest Sites.

Community Respiration

Community respiration (CR) is the rate of oxidation of organic matter to inorganic carbon dioxide by the autotrophic and aerobic heterotrophic components combined. In this study CR was measured on intact riffle communities including the smaller particle-sizes of sediment and detritus versus selected stream substrates placed in chambers. Intact *in situ* community simulation must be kept in mind when comparing CR rates of this study with other studies, because inclusion of all particle-sizes may increase CR estimates, since small particles may be heavily colonized by bacteria and to some extent fungi and algae (Suberkropp and Klug 1974, Madsen 1975). However, rates may also be lower due to lack of community disturbance and less exposure of surfaces to higher oxygen levels.

No attempt was made in the present study to partition CR.

Hargrave (1969a) attributed 33% of CR to macroinvertebrates, 45% to bacteria, and 15% to algae and Edwards and Rolley (1965) estimated 40% respired by macroinvertebrates in soft sediments. Both of these studies were from lentic communities. On a biomass basis, the macroinvertebrates were a small percentage of the total organic content of the Augusta Creek substrates and therefore might be expected to account for less than the estimated 40 to 45%.

With early interest in the effects of pollution on oxygen uptake, estimates of CR have been made in lotic systems since the 1930's (i.e. Butcher et al. 1930, Calvert 1933). Since Odum's (1956) introduction of the upstream-downstream procedure for estimating community metabolism in streams, many estimates of CR have appeared in the literature, but few _in situ_ chamber estimates have been made (Table 8).

Rates of CR ranged from 0.24 to 3.67 g O_2 $m^{-2}d^{-1}$ during January at the B Avenue Site and July at the Nagel Site, respectively (Appendices A, B; Figure 16). The annual averages (g O_2 $m^{-2}d^{-1}$) for each site ranked in increasing order were: B Avenue 0.52, Smith 0.56, Kellogg Forest 0.75, Upper 43rd 1.79, and Nagel 1.88; this pattern was similar to that of ranked sites for GCP and NCP (Table 9).

Smith and B Avenue CR values were very similar, with the lowest rates observed in the winter, followed by significant increases in spring, stable summer values, and decreasing rates from late fall to low winter values (Figure 16). The Smith Site had an autumn maximum in CR during leaf-input, but was only based on four observations. Further, a more comprehensive data set from B Avenue did not show such a maximum (Figure 16). Autumnal peaks in CR have been reported and

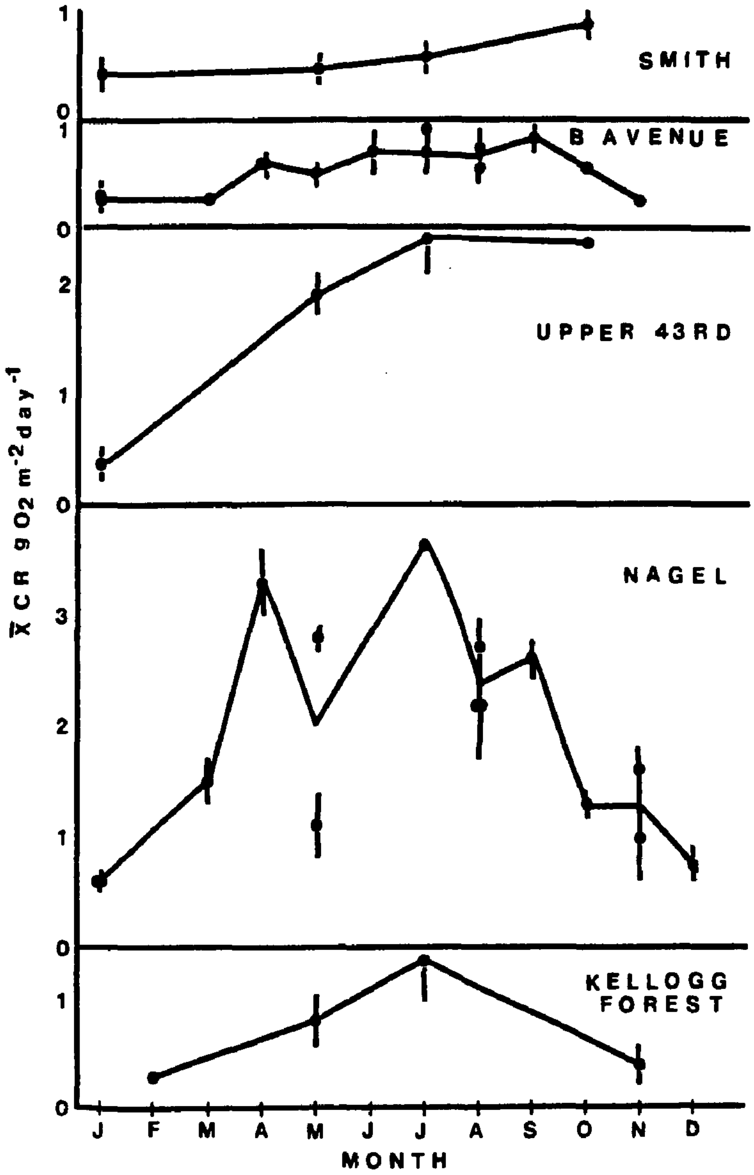


Figure 16. Rates of average CR (+ SE) for selected riffle communities in the Augusta Creek watershed, Kalamazoo County, Michigan (1973-1975).

related to increased detrital inputs in various other systems (Teal 1957, Nelson and Scott 1962, Flemer 1970, Hargrave 1972, Maki 1974).

Significantly higher rates of CR were observed at the Upper 43rd and Nagel sites than the first order reaches (Table 9). Based on four observations, the Upper 43rd Site had lowest CR during the winter, but steadily increased to a July maximum and remained high through the fall (Figure 16). Although the Nagel Site illustrated a more irratic pattern, maximum and minimum rates occurred during the same periods as at Upper 43rd. The highest CR for all sites was observed during July at the Nagel site (Appendices A, B; Figure 16), which was also during the period of maximum light, day-length, temperature and Cladophora development (Appendix D). Rates at both the Nagel and Upper 43rd Sites declined in August, possibly due to the decline of the green and blue-green community. Other studies noting summer maxima include Butcher et al. (1930), Stockner (1968), Flemer (1970) Vannote and Ball (1972), de laCruz and Post (1977), and Sumner and Fisher (1979).

The average CR at the Kellogg Forest was intermediate among the sites (Table 9), but most similar to the rates at Smith and B Avenue sites. Only during the summer were CR values for the three sites significantly different (Figure 16; Table 9). Summer increases at the Kellogg Forest were attributed to increased light availability during this period (Appendix D, Figures 11, 12). The similarity between the Kellogg Forest third order reach and the first order sections is the relationship predicted by the continuum concept (Vannote et al. 1980).

In the open reaches increases in CR as well as primary productivity were observed with rates of average CR (1.8 g O_2 $m^{-2}d^{-1}$ Upper 43rd, 1.9 g O_2 $m^{-2}d^{-1}$ Nagel) similar to the open third order

White Clay Creek, Pennsylvania (Bott et al. 1978; Tables 8, 9). CR values obtained for riffle communities of Augusta Creek were generally in the low range of upstream-downstream studies reported in the literature and within the ranges reported for chamber estimates (Table 8). Thus, patterns of CR observed in Augusta Creek were not unusual, but reinforced, by *in situ* measurements, the general magnitude of respiratory activity in natural and perturbed reaches of first through third order riffle sections of temperate streams and specifically illustrated the effects of riparian zone clearing.

Community respiration, ranked as a percentage of GCP (annual average) for Augusta Creek sites was: Smith 445%, B Avenue 200%, Upper 43rd 82%, Nage 60%, and Kellogg Forest 55%. Literature values of CR/GCP as a percent typically range from 13 to 68% (Kobayasi 1961, Pamatmat 1968, Hunding 1971, Gallagher and Daiber 1973); Likens (1975) 0 to 95%. The first order sites did not fit within the latter range, apparently due to low NCP. Such an analysis further indicates the dependency of these first order reaches on allochthonous carbon inputs. A definite and inverse relationship, especially at higher temperatures, was seen between NCP and CR at these two first order sites, and to a lesser extent at Upper 43rd Site.

P/R Ratio

The ratio of GCP to CR (P/R) over 24 hour periods is a valuable integrator of community metabolism, which allows comparisons and rankings of communities. As Humphrey (1975) noted, Ryther (1954) and Steele (1965) proposed P/R ratios as the main measure of community physiological state and, therefore, useful in studying marine and lentic freshwater systems. Odum, comparing the magnitude of in-stream photosynthetic production (autotrophy) to the import of organic matter from the landscape (heterotrophy) as energy sources, first applied P/R ratios in flowing water systems. The use of this parameter in stream classification was further reinforced by Hynes (1970) and Pieczyńska (1970). Fisher and Likens (1973) proposed that the P/R ratio should be used in conjunction with the import/export ratio in characterizing a stream reach. Vannote et al. (1980) stated that estimates of P/R allow characterization of the biological processes of a stream reach as to the productive (autotrophic) or consumptive (heterotrophic) mode, thus the present community usage of various inputs is indicated. However, caution must be exercised; if the P/R ratio is <1, the source of carbon (i.e. imported, or stored from earlier autochthonous production) cannot be delineated from the P/R alone. Pavetić et al. (1976) suggested monitoring P/R in running waters in the spring, when light and dark periods are equal, to characterize a reach physiologically, but unfortunately their usage of P_G/CR night caused confusion with the conventional terminology (P_G/CR $_{24}$).

Each Augusta Creek site displayed a constant pattern in P/R (Figure 17). The ratios measured at the Smith and B Avenue sites were consistently below one, but above one at Upper 43rd, Nagel and Kellogg Forest. (Figure 17; Appendices A, B). Such consistency has been reported by other lotic investigators (Stockner 1968, Cole 1973, Sumner and Fisher 1979) and by Ganning and Wulff (1970) in brackish rock pools. Others such as Flemer (1970), Vannote and Ball (1972), Hall (1972), and Bott et al. (1978) reported fluctuations in P/R from greater than to less than one in stream reaches and Mathis et al.

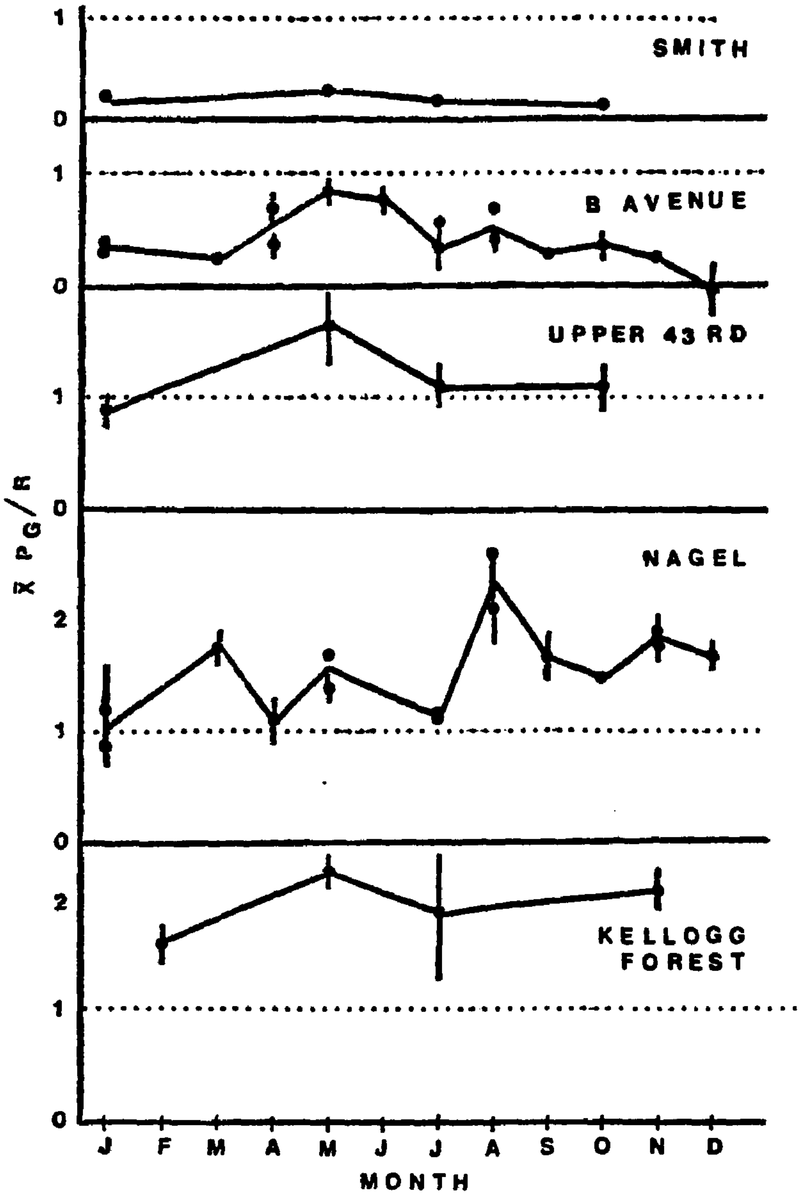


Figure 17. Average P/R ratios (+ SE) for selected sites in the Augusta Creek watershed, Kalamazoo County, Michigan (1973-1975).

(1969), investigating a flood plain lake, found P/R greater than one except during turbid periods caused by winds or flooding. It is feasible that those communities, such as the Upper 43rd Site which have stabilized near a P/R = 1, would be more likely to fluctuate above and below one, while distinctly heterotrophic or autotrophic communities would remain as such, unless altered by man.

Based on a comparison of the average P/R ratios at the two sites monitored on a monthly basis for a year with the next years seasonal data for these sites (B Avenue and Nagel), seasonal estimates adequately reflected the autotrophic-heterotrophic nature of the sites (Table 10). The average P/R ratios at all sites ranged from 0.21 at the Smith Site to 1.97 at Kellogg Forest (Table 9; Appendix A). Monthly daily estimates ranged from -0.02 in December at B Avenue to 2.5 during August at Nagel Site (Table 9; Figure 17). Sites ranked by average from lowest to highest were: Smith 0.21, B Avenue 0.45, Upper 43rd 1.2, Nagel 1.57, Kellogg Forest 1.97. This trend corresponds with the continuum hypothesis of increasing autotrophic support as one proceeds from headwaters to sixth order streams (Vannote et al. 1980). P/R ratios compared to leaf processing in Augusta Creek at these sites indicated an inverse relationship between P/R ratio and litter processing (Cummins 1980), and indicates a decreased effect of CPOM from first to third order reaches.

Although the Kellogg Forest Site had lower average GCP than the Upper 43rd and Nagel Sites, the CR was significantly lower (within the confidence limits of Smith and B Avenue Sites) accounting for the increased ratios. Comparing the detrital and epilithon standing crops of Nagel, Upper 43rd and Kellogg Forest the depressed CR at this

Table 10. Annual and seasonal estimates of P/R ratio at two sites of Augusta Creek, Kalamazoo County, Michigan (1973-1975).

Site	Period	$\overline{X}$ P_G/R	S.E.	C.V. %
B Avenue	Annual*	0.42	0.07	60.1
B Avenue	Seasonal**	0.52	0.10	36.6
B Avenue	Combined Years	0.45	0.06	53.1
Nagel	Annual	1.65	0.14	27.4
Nagel	Seasonal	1.36	0.23	42.0
Nagel	Combined Years	1.57	0.12	29.1

* Annual (1973-1974)

** Seasonal (1974-1975)

site was probably due to a lesser development of epilithon since the detrital crops were not dissimilar (Appendix C). This relationship was confirmed by visual and qualitative microscopic examination of the algae. The P/R ratios greater than one indicated the importance of algal development and autochthonous production in naturally shaded sections of third order riffle reaches.

The Smith Site, with P/R ratios ranging from 0.19 to 0.29, indicated a consistent lack of primary productivity and therefore a dependence on allochthonous carbon sources. The heterotrophic nature of this site was further documented by the high detrital standing crop throughout the year, low levels of GCP, and negative values of NCP (Appendix C; Table 9). A very slight peak in P/R was noted during May, corresponding to the "highest" period of GCP (Figures 14, 17; Table 9). NCP was always a negative value at Smith as reflected in the low P/R ratios (Table 9, Figures 15, 17). Using the upstream-downstream method, low ratios of P/R have been reported for various stream reaches, especially turbid and polluted systems (Table 8). Chamber estimates of P/R from first order sections are lacking in the literature, and Smith values were lower than most reported values (Table 8).

The B Avenue riffle P/R ratios fluctuated over the annual period from -0.02, the lowest recorded at any site for the entire study (snowy overcast day), to 0.88 (Figure 17, Appendices A, B). These values excepting the lowest values, are within the range reported in the literature (Table 8). The maximum was during the spring when light was increasing and before leaf emergence, and corresponded with the highest GCP levels and the single positive value of NCP (Figures

14, 15, 17). Thus, the first order B Avenue site, based on consistently low P/R ratios, would also be classified as a heterotrophic reach with an annual consuming mode (Figure 17, Appendices A, B).

The second order Upper 43rd Site, had P/R values that ranged from 0.19 to 1.68. This was the only site which obtained a dynamic equilibrium near P/R = 1. These P/R values indicated a self-supporting autochthonous riffle community, with little excess organic matter to export or store. The low values obtained in January (Figure 17), illustrated the possibility of a heterotrophic shift, possibly supported by import or slight storage resulting from the spring maximum. GCP and NCP were high at that time as was CR which remained high throughout the summer (Figures 14, 15, 16). This relationship was reflected in the increasing levels of epilithon at the Upper 43rd Site (Appendix C). P/R values from this meadow reach were in the range found for Cladophora mats in Sycamore Creek, Arizona (Bush and Fisher 1981), fourth and fifth order reaches of the Roritan River, New Jersey (Flemer 1970), and the summer values obtained for a third order reach of White Clay Creek, Pennsylvania (Bott et al. 1978). The openess of the Upper 43rd site enhanced autotrophic production above that reported by others studying naturally wooded second order streams (de laCruz and Post 1977, Gelroth and Marzolf 1978). Presumably the P/R ratio would be lower if measured within the wooded section downstream for the study site.

Consistently autotrophic would characterize the Nagel Site, where P/R ratios ranged from 0.86 during January to 2.59 during August (Figure 17; Appendices A, B). This site remained autotrophic, although the riffle flora changed drastically from little visible algal growth during the winter, to a carpet of diatoms in spring, through *Cladophora* and blue-green mats developing in summer along with aquatic macrophytes of the genera *Potomogeton* and *Saggitaria*. The March peak coincided with the diatom bloom and the August maximum with maximum *Cladophora* and blue-green development (Figure 17). Both peaks were also illustrated in the NCP patterns (Figure 15). P/R ratios at the Nagel Site compared most closely with chamber estimates reported by Bush and Fisher (1981) for *Cladophora* mats during the summer and Litke's natural fourth order riffle section of the Chippewa River, Michigan, (1978); values were within the range of several studies cited in Table 8. Although a consistent autotrophic base was indicated, the P/R values were lower than those of the Kellogg Forest Site (Table 9; Figure 17).

The Kellogg Forest range in P/R was 1.61 during the winter to 2.33 during the spring (Figure 17; Appendices A, B). A more stable type of community development at this site compared to the Nagel Site, was indicated by less variation in P/R. These riffle P/R ratios were higher than generally predicted by the continuum hypothesis (Vannote et al. 1980), which proposed little autotrophic activity in forest covered stream communities less than 10 m in width. Only the higher P/R ratios from other studies approximated the Kellogg Forest Values (Table 8) and illustrate the effects of increased light even for short periods of time on the autotrophic potential of a shaded third order riffle community. Even if the effects of pool metabolism lowered the P/R ratios of the entire reach, it is apparent that the riffles were making a significant contribution to the ecosystem energy flux.

Based on P/R ratios obtained, Upper 43rd, Nagel and Kellogg Forest Sites were characterized as having an annual producing mode (autotrophic), while Smith and B Avenue were in a continuous consumptive mode (heterotrophic).

Net Daily Metabolism

NDM (P_G - R_{24}) is another integrative measurement which helps delineate the producing or consuming mode of a community. Little attention has been given this quantitative, ecologically important parameter in the literature (Bott et al. 1978). Although the P/R ratio indicates the autotrophic potential of a site, it does not indicate amounts of excess carbon available for storage or export or the magnitude of deficit within a community, which must be compensated for by storage or allochthonous inputs for continued stable community metabolism as does estimates of NDM.

NDM data for Augusta Creek sites mirrored the NCP and P/R curves for each site, but were lower in magnitude (Figures 15, 17, 18). Average NDM (g O_2 $m^{-2}d^{-1}$) when ranked by sites differed from that of P/R (Smith -0.44, B Avenue -0.26, Upper 43rd 0.45, Kellogg Forest 0.60, and Nagel 1.01; Table 9). Ranking by NDM indicated that even through P/R ratios were higher at the Kellogg Forest, the cleared third order Nagel Site produced more carbon over the year and that although open, the Upper 43rd Site produced less excess carbon than the shaded third order Kellogg Forest riffle (Table 9). All average NDM values were within the range reported for White Clay Creek (third order) by Bott et al. (1978). NDM values ranged from -0.72 g O_2 $m^{-2}d^{-1}$ during the fall at Smith to 2.68 g O_2 $m^{-2}d^{-1}$ at Nagel in

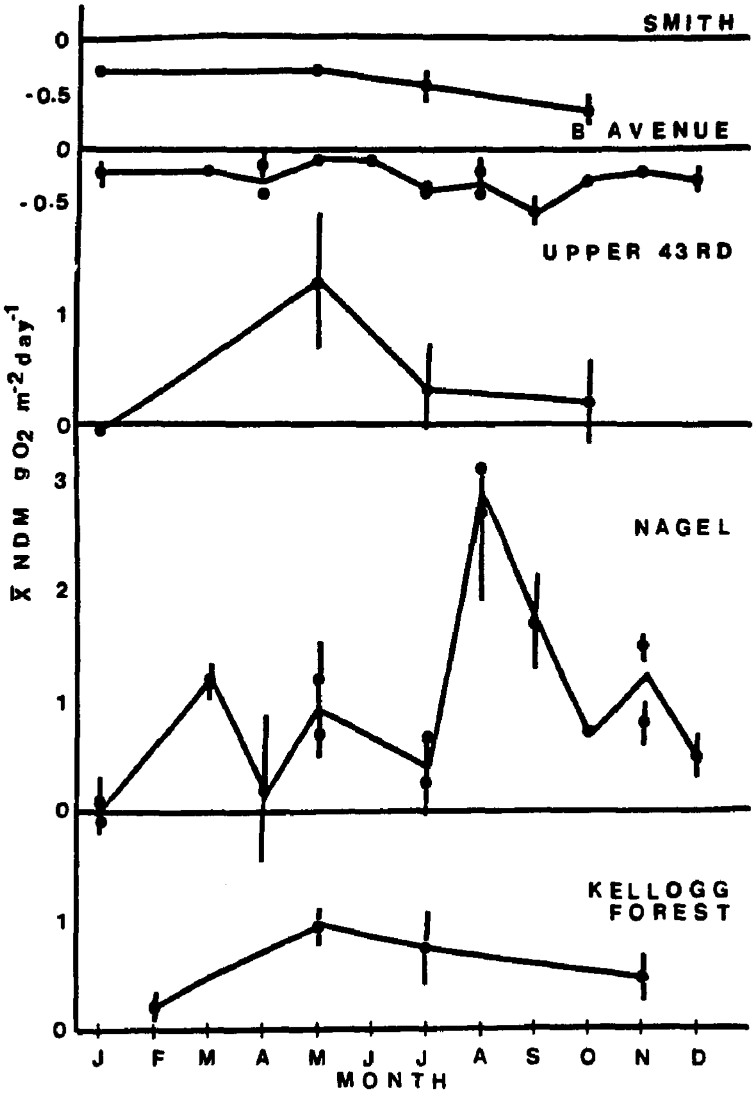


Figure 18. Average values (+ SE) of NDM for selected riffle sites in the Augusta Creek watershed, Kalamazoo County, Michigan (1973-1975).

August (Appendices A, B; Figure 18).

NDM at B Avenue and Smith sites indicated a dependence on allochthonous sources year around (Table 9; Figure 18). Upper 43rd was self-supporting through spring and summer with potential allochthonous dependence during the fall and winter. Given the magnitude of Upper 43rd spring NDM, stored autochthonous primary production could have supported this riffle (Figure 18). P/R ratios near one also support this hypothesis (Table 9). An increase in detrital standing crop during the fall, especially in the 1 mm and 250 μm particle sizes, with no corresponding decrease in epilithon, also indicated that inputs from upstream or the riparian zone occurred at this time (Appendix D; Figures 18, 19).

The Nagel Site, indicating a positive autotrophic capacity over the year, had the lowest NDM in January and the largest detrital standing crop at that time (Appendix C; Figure 18). Origin of this detrital increase is unknown, since export and import were not measured, but levels of NDM were adequate to support this riffle community on an annual basis (Figure 18; Appendices A, B). The low period in April, during the obvious spring bloom in attached algae, was the result of increased CR of the periphyton assemblage and was probably not supported by increased detrital standing crop (Figure 18). However, the July decrease correlated with decreased epilithon and an increase of small particle sizes of detritus, which indicates possible storage of autochthonously produced organic matter in the detrital pool (Appendix C; Figure 18). From the high NDM in the fall (Figure 18) and overall positive values of NDM it appears that the Nagel riffle section was self-supporting and autotrophic in nature.

Autochthonous organic matter supported the Kellogg Forest riffle section on a yearly basis (Figure 18; Table 9). The lowest values occurred during the winter, as at the other sites, when detritus was abundant and could have been of autochthonous or allochthonous origin. However, from the levels of NDM measured during the spring and summer, if stored as POM, autochthonous production could have supported this riffle community over the year (Appendix C, Figure 18). A stable pattern in NDM was observed at the Kellogg Forest Site with overlapping values at all seasons (Figure 18) and even though the P/R ratios were highest at this site (Figure 17), the NDM was lower than the open Nagel Site, which indicated a greater capacity in the open third order site to support riffle metabolism.

Detrital Standing Crop

The standing crop of detritus is an indication of the POM base upon which a heterotrophic community develops. Changes in standing crop may indicate shifts in the energy base (i. e. heterotrophic-autotrophic); changes in detrital and epilithon particle-size may help delineate origins of detritus or processing trends, and rates of metabolism can be expressed on a g^{-1}AFDW basis. As evidenced by SEM micrographs, both autotrophic and heterotrophic organisms colonize detritus (Suberkropp and Klug 1976). Visual observations of CPOM such as leaves indicated diatom colonization during the fall. Community metabolism of leaf packs colonized in Augusta Creek and monitored in chambers showed that during fall diatom blooms they may add to the total NCP of the ecosystem (King unpublished data).

Detrital standing crop estimates at the Augusta Creek sites studied ranged from 592 g m^{-2} at the B Avenue Site during the fall (October) to 145 g m^{-2} at B Avenue in the spring (April; Figure 19). On an average basis Smith had the largest standing crop (388 g m^{-2}) followed by Nagel (291 g m^{-2}), B Avenue (290 g m^{-2}), Kellogg Forest (283 g m^{-2}), and Upper 43rd (240 g m^{-2}; Table 9). As evaluated according to non-overlapping standard errors, values at Smith were significantly greater than all sites; B Avenue, Nagel and Kellogg Forest were essentially the same, while values at Upper 43rd were similar to those at Nagel and Kellogg Forest Sites (Table 9). Overall, these average values were quite similar, especially considering the measured differences in metabolic parameters (Table 9). Data collected from Augusta Creek by Cummins and Petersen (unpublished) and the River Continuum Group (Minshall et al. 1982) indicated similar annual averages and trends (Mahan 1980).

Maximum detrital standing crops occurred at three of the five sites during the fall (Figure 19). Upper 43rd and Kellogg Forest attained maxima in summer and spring, respectively. During the period of algal senesence, smaller particle sizes increased at Upper 43rd, which indicated potential storage of algal detritus (Figure 20). The spring detrital increase at the Kellogg Forest was not significantly different from winter and summer (Figure 19). Thus, the second and third order sites had more stable total standing crops than either of the first order sites.

The autumn input of CPOM was obvious at both Smith and B Avenue Sites (Figures 19, 20). At Smith there was a decrease in spring, probably reflecting the effects of scouring due to flooding. At B Avenue a rapid decrease in standing crop occurred during the autumn to

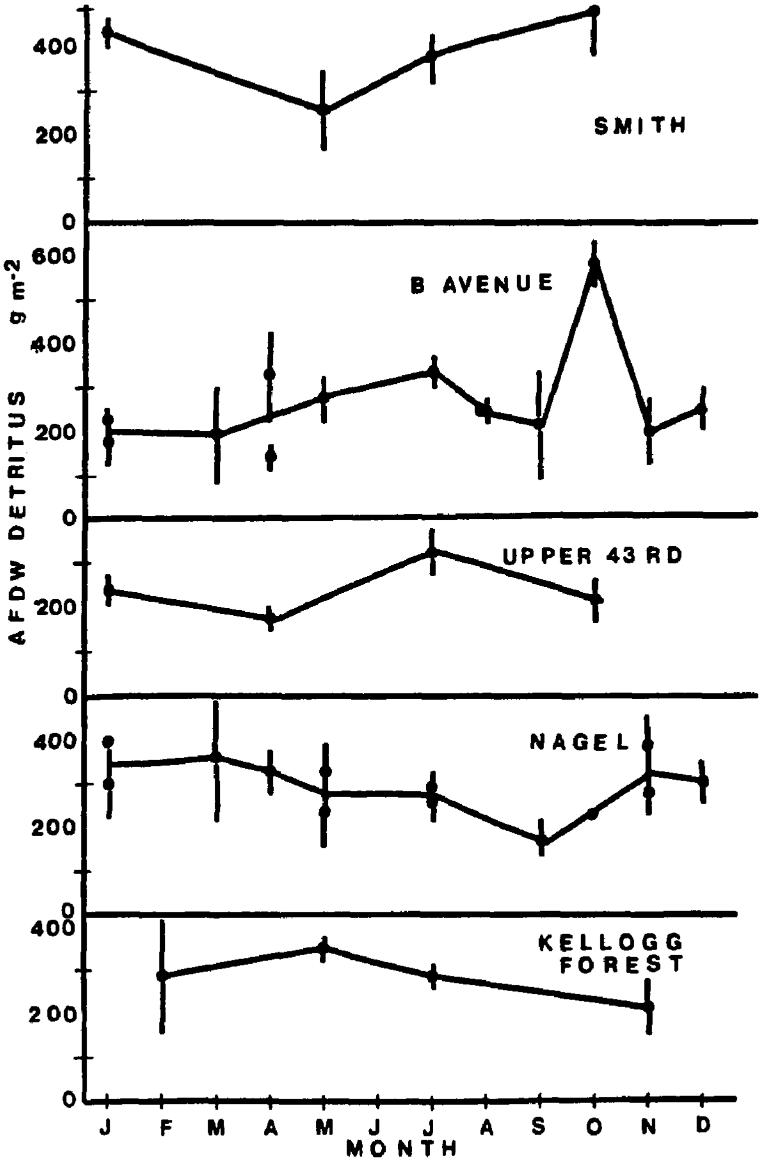


Figure 19. Average estimates of detrital standing crop (+ SE) from selected riffle communities in Augusta Creek, Kalamazoo County, Michigan (1973-1975).

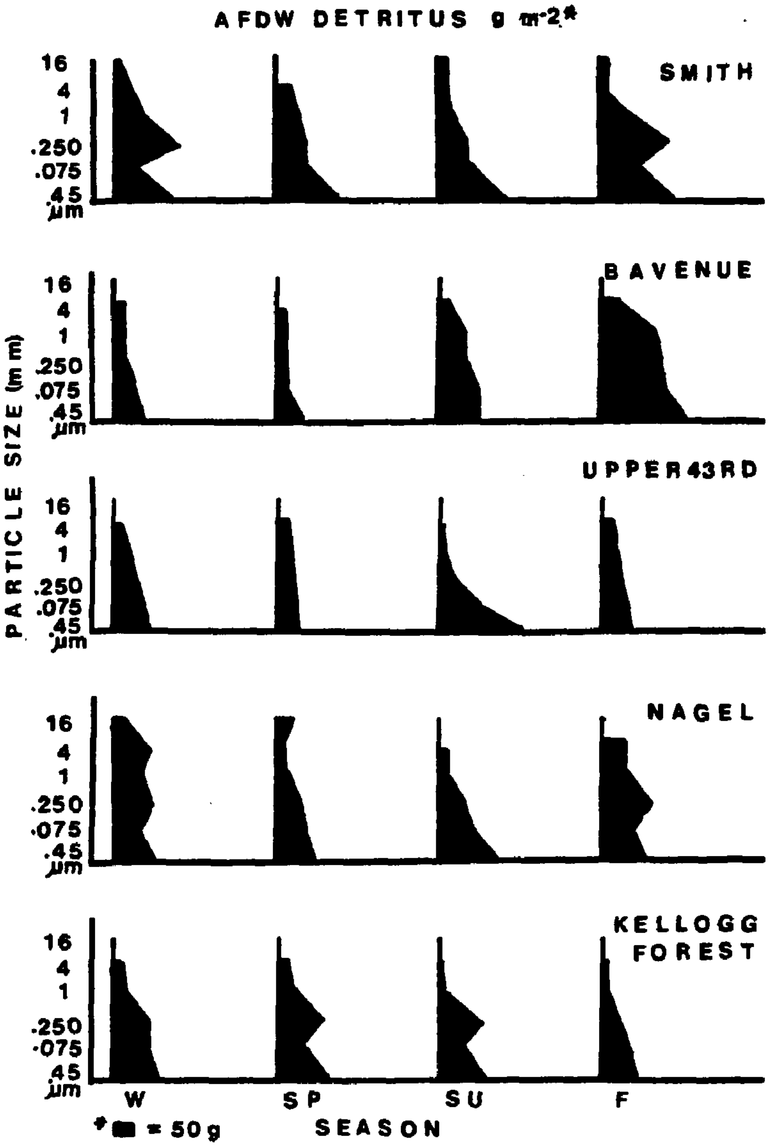


Figure 20. Seasonal distribution of particle-sized detritus from selected riffle sections of Augusta Creek, Kalamazoo County, Michigan (1973-1975).

low stable values winter and summer (Figure 19). Although variance was high these data suggested a spring input (Figure 19) of CPOM. Mahan (1980) found the highest CPOM inputs at Smith followed by Kellogg Forest, Upper 43rd (wooded section) and Nagel Sites. At all sites leaves were the dominant form of CPOM. The CPOM inputs in Smith Site were significantly higher during autumn and spring, with spring CPOM averaging 56% of the fall input. The quality, however, shifted from a dominance of leaves in fall to wood in spring. The other sites showed no marked fluctuation in inputs. The disturbed Nagel site was by far the lowest in CPOM inputs (Mahan 1980).

The consistency noted in second and third order tributary riffle sections in this study was also reported for a fourth order riffle of the Chippewa River, Michigan (Litke 1978). Such stability probably resulted from more continual autochthonous inputs mediating allochthonous inputs over an annual period. The stability of the community and carbon inputs were indicated by the P/R ratios and NDM of these sites (Figures 17, 18). Naiman and Sedell (1979b) suggested that this stability indicated a balance in processing, storage, export and import. If this is so, changes in P/R would serve an an indication of changes within the communities.

The relatively stable patterns observed for total detrital standing crop (Figure 19) are, however, not indicative of processing, changes in particle-size composition on a seasonal basis, or quality (i.e. labile-refractory nature) or turnover time of particles. Distribution of particle-size on a seasonal basis (Figure 20) illustrated changes occurred within the detrital pool. Although total detrital standing crop levels may be consistent at a site, shifts in particle-size composition may illustrate dynamic changes within the riffles. All sites were dominated by FPOM with Smith Site having the highest annual average and Upper 43rd the lowest (Figure 20; Table 11). Greater fluctuations were found in the CPOM over the year than in the FPOM standing crop as indicated by the C.V.% ($\bar{x}$ CPOM 50.6 and FPOM 30.8; Table 11). The most stable and also the lowest CPOM standing crop was found at Upper 43rd, while the FPOM was most consistent at the Nagel site.

Shifts in particle size at Smith were not large, but by spring 16 and 4 mm particles were not observed and the 250 μm size decreased, either by processing or export, which were not monitored in this study. A more marked pattern was seen at B Avenue where the large autumn standing crops were reduced annually, which indicated significant export. However, a study of retention of basswood (Tilia) leaves at this site indicated that CPOM traversed a mean distance of 10 to 30 m before entrainment, and therefore storage and processing would occur within the reach with possible export of finer particles (Cummins et al. 1981). The distribution of FPOM was similar during all seasons with the shifts occurring in the CPOM range where lowest levels occurred during the spring, possibly the result of flooding, since corresponding increases in FPOM did not occur (Figures 19, 20). Spring allochthonous CPOM inputs may have accounted for the observed higher summer values (Figure 20).

The Upper 43rd particle-size specific distribution was more constant than the first order sites with algal inputs probably occurring during the summer as indicated by increases in the FPOM pool (Figure 20). Litke (1978) observed an increase in the detrital pool

Table 11. CPOM and FPOM detrital standing crops and CPOM/FPOM ratios from selected sites in Augusta Creek, Kalamazoo County, Michigan (1974-1975).

Month	Site		CPOM gm^{-2}	FPOM gm^{-2}	CPOM/FPOM
Oct.	Smith		73.0	406.7	0.18
Jan.	Smith		112.3	327.4	0.34
May	Smith		37.2	279.4	0.13
July	Smith		46.4	274.5	0.16
		$\bar{X}$	67.2	322.0	0.20
		S.E.	16.8	30.7	0.02
		C.V.%	50.1	19.0	46.3
Oct.	B Avenue		172.0	419.9	0.41
Jan.	B Avenue		42.6	134.4	0.32
April	B Avenue		27.5	98.4	0.28
July	B Avenue		83.0	228.7	0.36
		$\bar{X}$	81.3	220.4	0.34
		S.E.	32.4	72.0	0.02
		C.V.%	79.8	65.3	16.2
Oct.	Upper 43rd		50.3	168.0	0.30
Jan.	Upper 43rd		42.4	192.6	0.22
May	Upper 43rd		53.6	123.9	0.43
July	Upper 43rd		22.5	281.2	0.08
		$\bar{X}$	42.2	191.4	0.23
		S.E.	7.0	33.1	0.07
		C.V.%	33.1	34.6	56.9
Nov.	Nagel		100.5	287.7	0.35
Jan.	Nagel		159.4	233.9	0.68
May	Nagel		77.8	194.9	0.40
July	Nagel		42.9	258.2	0.17
		$\bar{X}$	95.2	243.7	0.40
		S.E.	24.5	19.6	0.11
		C.V.%	51.4	16.1	52.8
Nov.	Kellogg Forest		29.5	185.3	0.16
Feb.	Kellogg Forest		29.5	259.5	0.11
May	Kellogg Forest		46.6	296.7	0.16
July	Kellogg Forest		18.3	267.4	0.06
		$\bar{X}$	30.5	252.2	0.12
		S.E.	5.9	23.7	0.02
		C.V.%	38.7	18.8	39.1

due to Cladophora inputs in a fourth order riffle during the summers. Such an increase was also observed at the Nagel Site, where CPOM levels were highest during the fall-winter period. The Kellogg Forest had little change in detrital particle-size distribution over the year, which indicated the influence of mainly non-filamentous autochthonous production at this site.

The CPOM/FPOM ratios ranged from 0.06 during the summer at Kellogg Forest to 0.68 in the winter at the Nagel Site. The lowest ratios, indicating the autochthonous energy base, were at the higher order sites during the summer and at B Avenue and Smith during the spring at the time of increased light and GCP "maxima". The highest ratios varied with site, but correlated with depressed P/R ratios (Figure 17; Table 11). The winter-early spring dependence on CPOM at the autotrophic sites correlated with low levels of GCP and NCP, while the autumn-winter inputs of CPOM and subsequent processing within the riffles coincided with the high CPOM/FPOM at the heterotrophic sites (Figures 14, 15; Table 11). Therefore, the P/R and CPOM/FPOM ratios can be used in conjunction to elucidate the autotrophic-heterotrophic relationships of stream riffles.

The annual average CPOM/FPOM ratios were highest in the shaded first order reaches (0.2 Smith and 0.34 B Avenue) and lower in the third order reach (0.12 Kellogg Forest). This pattern was in agreement with the continuum concept and reflected a greater dependence on autotrophic production as stream order increased (Vannote et al. 1980). However, the cleared Nagel section had the greatest average CPOM/FPOM ration (0.4) and the highest average CPOM standing crop. When the S.E.'s are considered (Table 11), the Nagel

CPOM standing crop was comparable to those from Smith and B Avenue. Based on their overall productivity differences, the Nagel CPOM resulted from inputs of filamentous algae and aquatic macrophytes and thus, had been autochthonously produced as documented by Minshall (1978) in desert streams. Although the actual origins of allochthonous CPOM were not demonstrated, Mahan (1980) ranked Nagel the lowest in CPOM inputs of the four Augusta Creek sites studied, which supports the autotrophic input hypothesis. The meadow reach, Upper 43rd, average 0.23 CPOM/FPOM ratio, which was not significantly different from that at the Smith Site. Therefore, the generalization of decreasing CPOM/FPOM ratio with increasing order did not hold for open reaches of first through third order streams.

Detrital (AFDW) Community Metabolism

Little relationship between detrital AFDW and CR has been noted in the literature (Wetzel 1963, Edwards and Rolley 1965, Hargrave 1969b, Pennak and Lavelle 1979). Odum (1956) reported CR to be dependent on the concentrations of organic matter in the sediment, Edberg and Hofsten (1973) found the nature and quality of detritus had a decided effect on oxygen uptake in soft sediments, and Göthberg and Karlström (1975) found CR to be dependent on the amount of detritus present in riffle sections of the Ricklean River, Sweden. These findings contrasted to those of Hargrave (1969b) that organic content and composition appeared to have minor significance in oxygen consumption of littoral sediments. In a later study comparing mud, sand, and detritus in short term experiments Hargrave (1972) found detritus consumed three times more oxygen that sand, and that log oxygen uptake was inversly related to organic content of sediment. Intuitively, CR would be linked most closely to detrital activity, and most studies have emphasized this relationship. Edberg and Hofsten (1973) indicated that CR of algal detritus was much higher than allochthonous forms, which may account for increases of CR during periods of algal growth and senescence. Detritus (especially CPOM) can also be a substrate for algal colonization and a relationship may exist between AFDW and productivity. Community metabolism estimates expressed on an AFDW basis may reflect changes in the composition of the detrital standing crop; increased productivity g^{-1} may indicate algal colonization of detrital particles or contribution to the detrital pool through sloughing from inorganic substrates, and increasing CR rates during spring or fall may indicate more labile algal contributions to the detrital pool.

Community metabolism expressed on a biomass basis (g^{-1}AFDW; Appendix A; Table 12) indicated the same trends (Figures 21, 22) as measured on an areal basis with the exception of CR (Figures 14, 15, 16, 18; Table 9). Smith and B Avenue were reversed in CR ranking by expression on a weight basis, but there was no significant difference between these values. Since the mean total standing crop estimates at all sites, excepting Smith, were so close one would not anticipate large changes in seasonal trends (Table 11). Periods of maximum and minimum values on an areal or biomass basis for these parameters (NCP, GCP, CR, NDM) were generally similar at all sites. Values at the Smith and B Avenue sites were most stable with only small annual changes. CR varied most of any parameter: summer and spring maxium rates occurred when expressed on an areal basis, while on a biomass

Table 12. Annual average estimates of detrital community metabolism (mg O_2 g^{-1}AFDW) for selected sites of Augusta Creek, Kalamazoo County, Michigan (1974-1975).

Site		NCP*	CR	GCP	NDM
Smith	$\overline{X}$	-0.7	1.8	0.3	-1.5
	S.E.	0.0	0.0	0.0	0.0
	C.V.%	0.0	0.0	0.0	0.0
B Avenue	$\overline{X}$	0.0	2.4	1.2	-1.3
	S.E.	0.0	0.0	0.0	0.0
	C.V.%	0.0	0.0	0.0	0.0
Upper 43rd	$\overline{X}$	5.8	8.0	9.8	2.3
	S.E.	0.0	0.0	3.2	0.0
	C.V.%	55.0	39.5	64.8	0.0
Nagel	$\overline{X}$	6.7	7.2	10.6	3.4
	S.E.	0.0	0.0	0.0	0.0
	C.V.%	47.1	62.0	66.4	92.4
Kellogg Forest	$\overline{X}$	3.8	2.5	5.0	2.3
	S.E.	0.0	0.0	0.0	0.0
	C.V.%	0.0	0.0	0.0	0.0

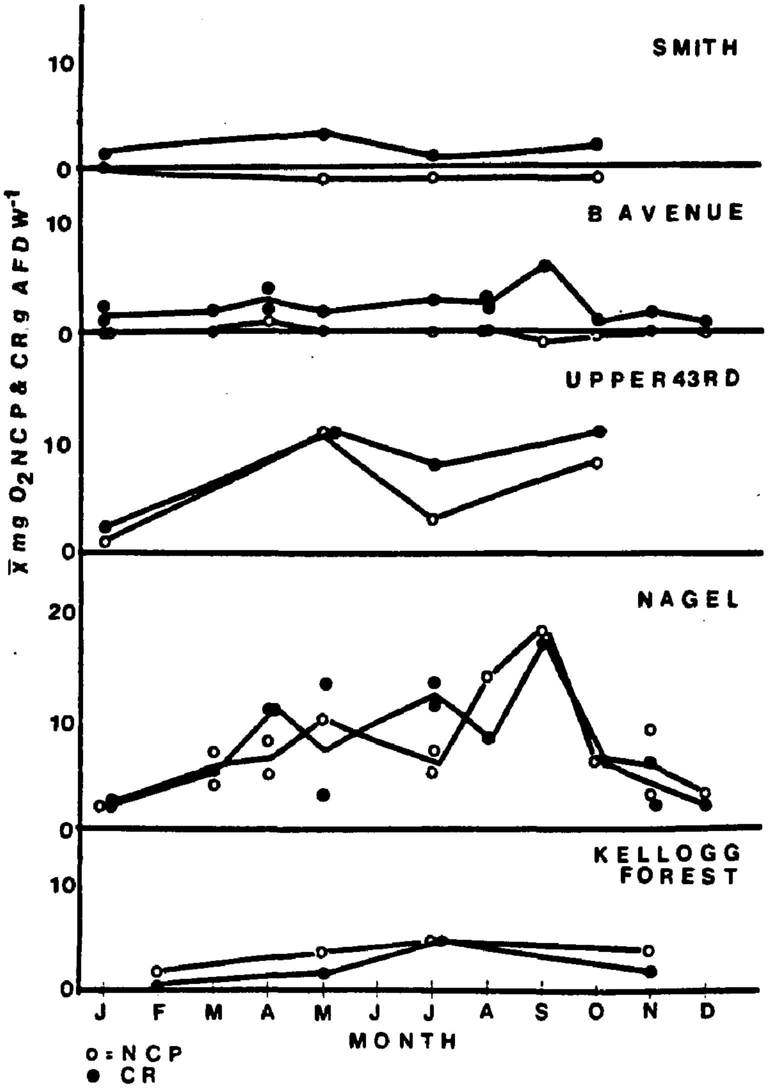


Figure 21. Estimates of NCP and CR on a weight basis from selected Augusta Creek riffle sections, Kalamazoo County, Michigan (1973-1975).

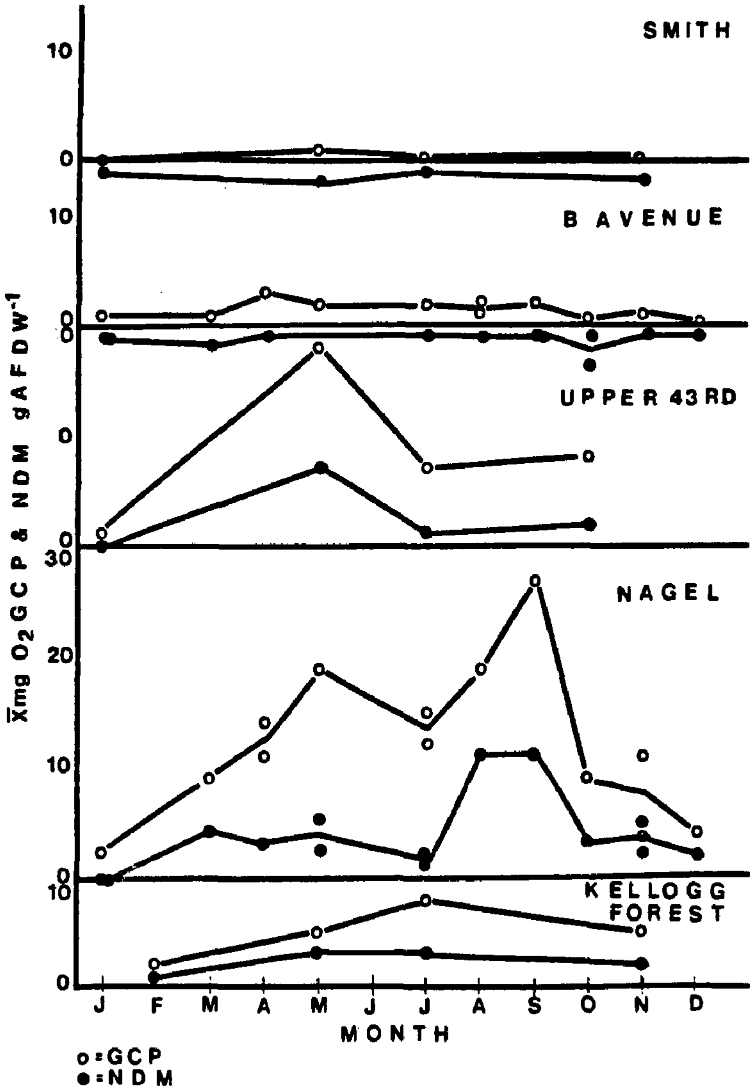


Figure 22. Estimates of GCP and NDM on a weight basis from selected Augusta Creek riffle sections, Kalamazoo County, Michigan (1973-1975).

basis the maximum was in the autumn (Appendix A; Figures 16, 21). At the Upper 43rd and Nagel Sites these increases in CR may have been the result of algal inputs to the detrital pool (Edberg and Hofsten 1973). Calow (1975) reported epilithic detritus was higher in organic matter and protein in comparison to adjacent detritus which was higher in lignin and cellulose. Thus, when periphyton assemblages slough into the detrital pool, higher rates of CR would be expected from the addition of a more labile substrate. It should be noted that in all cases values were low on a biomass basis and there was little difference in seasonal ranges (Table 12; Figures 21, 22).

The autotrophic Nagel Site had high levels of detrital standing crop and also had the highest values of most parameters on a biomass basis (Table 12). The high state of activity g^{-1} detritus at the Nagel site was also characteristic at Upper 43rd.

Based on average detrital standing crop, Smith was highest followed by Nagel, B Avenue, Kellogg Forest, and Upper 43rd. If metabolic parameters were directly correlated with total detritus the highest activity would have been at Smith Site, which had the lowest activity followed by B Avenue, Kellogg Forest, Upper 43rd and Nagel. Therefore, other factors such as light temperature or epilithon development and composition must be mediating metabolic activity.

Epilithon

Epilithon, is here defined as that organic assemblage of algae, bacteria, fungi, protozoans, detritus, and even small macroinvertebrates which colonize this mass, attached to inorganic substrates. This definition is often lumped with the category of periphyton or Aufwuchs. Round (1965) has long campaigned to characterize the assembladge based on substrate colonized (i.e. epilithon - rocks and stones, epipsammon - sand, epipelon - mud, epiphyton - plants). The term epilithon has been used by Marker (1976a) to describe the biomass of benthic algae on rocks and Calow (1975) has studied epilithic detritus.

Epilithon biomass values (Appendix C) are based on the 550 AFDW of particle-sized inorganic substrates. Nelson and Scott (1962) ashed, rewetted and redried at 63C to attempt rehydration of clay particles. They estimated error due to loss of hydration at 5%. Losses of this type in Augusta Creek sediments to 75 μm in size would be small and no corrections were made. The method developed showed comparative differences between sites in Augusta Creek epilithon development.

Sediments throughout the Augusta Creek drainage were similar at all sites; they consisted of granite, basalt and limestone. However, visual differences of sediment surfaces were obvious between autotrophic and heterotrophic sites. Sediments from Nagel and Upper 43rd had obvious travertine deposits, Kellogg Forest intermediate in travertine build up, and Smith and B Avenue were free of visible carbonate deposits. In hardwater streams photosynthesis, shifting the equilibrium, can be responsible for deposition of $CaCO_3$ on sediments or aquatic macrophytes and subsequent travertine development (Hynes 1970, Wetzel 1975a). Photosynthetic activity was largely responsible for both visual and biomass differences between sites and epilithon development was a more reliable indicator of autotrophic-heterotrophic relationships of riffle sections than was detrital standing crop.

Sites ranked according to increasing annual average epilithon development were: Smith, B Avenue, Kellogg Forest, Nagel and Upper 43rd (Table 9; Figure 23). Using overlap of standard errors as a criterion, Nagel and Upper 43rd were essentially the same, Kellogg Forest intermediate, and Smith significantly lower than all other sites in epilithon development. These trends reflected the same pattern as NCP and GCP in Augusta Creek (Table 9).

Epilithon estimates ranged from 1480 g m^{-2} at Smith to 5038 g m^{-2} at Nagel Site during the spring. The maximum at the Nagel Site undoubtedly resulted from the diatom bloom which carpeted the substrate, while the low at Smith Site was attributed to spring scouring effects. These epilithon values from the alkaline Augusta Creek were higher than those obtained using the same method in soft water, turbid riffle sections of the Buttahatchie River Mississippi (Miller and King 1981). Their total AFDW estimates of sediments, characteristic of epilithon weights (Table 9), ranged from 260 to 363 g m^{-2} in August. Development of the autotrophic epilithon component in this system was limited by turbidity, thus, these levels characterize the contribution of the detrital component to the biomass. Epilithon values from six replicate chambers placed in a second order riffle of the west branch of the Clark's Fork of the Yellowstone River, Montana, where primary productivity levels were very low, ranged from 999 to 1892 g m^{-2}. The average (1338 g m^{-2}) was similar to that of the heterotrophic Smith Site of Augusta Creek (1763 g m^{-2}) as were the P/R ratios of approximately 0.3 (Table 9).

The first order detrital based systems of Augusta Creek ranged from 1480 to 2811 g m^{-2} epilithon. Both first order sites indicated

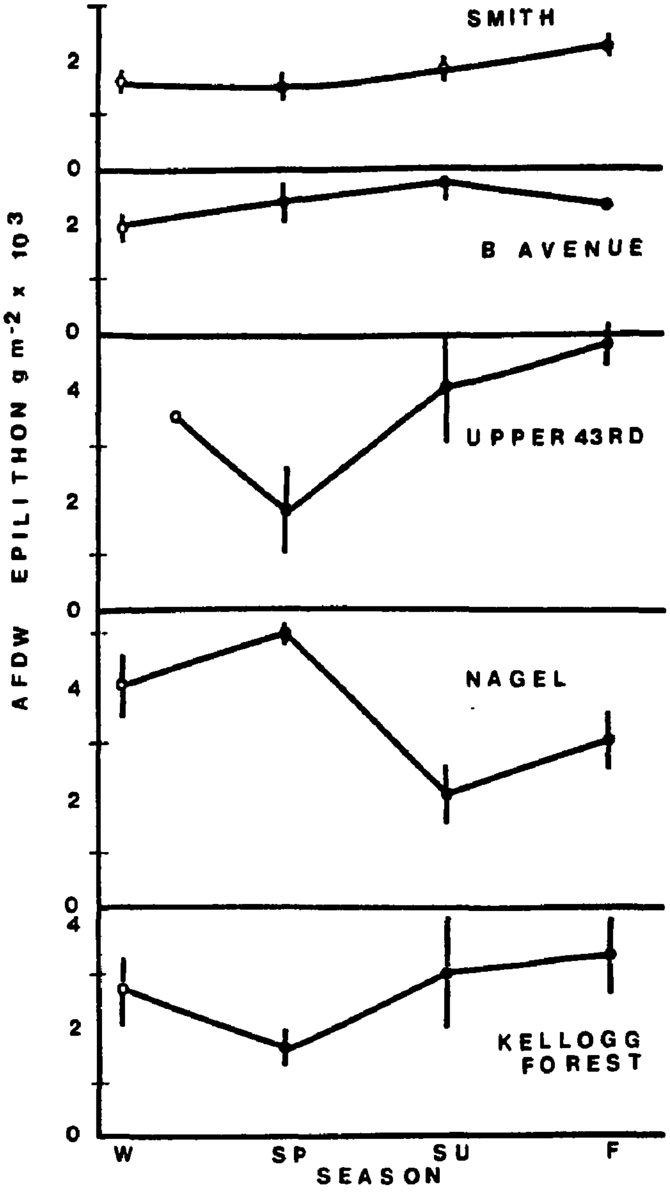


Figure 23. Estimates of eiplithon development, obtained on a seasonal basis from selected riffle sites of Augusta Creek, Kalamazoo County, Michigan (1974-1975).

less variance in epilithon estimates over the year with the C.V.% averaging only 18.3% at Smith and 16.6% at B Avenue in contrast to the overall average of 28.7% (Table 9). This consistency, indicating a balance within the riffle sections, was typical of most parameters at these sites.

The highest values of epilithon at Smith Site were during autumn (Figure 23) at the time of significant detrital inputs. The nature and consistency of epilithic detritus has been investigated by Madsen (1972). Using SEM techniques, detritus was the major component, bacteria and fungi were prevalent, with few algae evident. This material may be a rich source of organic matter (protein) to consumer organisms (Calow 1975). Colonization of stones by heterotrophs thus leads to organic accumulation and further entrapment of detritus all of which would be a component of the epilithon as determined by ashing. These levels at Smith Site were significantly different from the autotrophic based sites (Figure 23; Table 9).

Helan et al. (1973) ashed inorganic substrates from mountain streams in Czechoslavakia and found highest amounts of epilithon in the upper reaches during April and June, similar to patterns observed at B Avenue, Augusta Creek (Figure 23). The Kellogg Forest Site, intermediate in epilithon development, had little change in quantity of epilithon, and was consistently higher in values than the first order sites (Table 9: Figure 23). The open sites illustrated more significant seasonal changes, with the Upper 43rd Site maximum attained during the autumn after the autotrophic build up from a spring low (Figure 23). The Nagel site exhibited spring and autumn increases (diatom blooms) much like that reported for the middle sections by Helan et al. (1973). The lower summer values at Nagel (Figure 23) reflected shading effects of extensive aquatic macrophyte growth during mid to late summer.

On a particle-size specific basis (Figure 24), changes occurred mainly in the 16 and 4 mm size fractions. McConnell and Sigler (1959) found larger substrates (12 cm and greater) to have more chlorophyll a content than smaller sediments, with less than 6% of the chlorophyll a concentration in sediments smaller than 2.5 cm in diameter. In English streams Marker (1976a) found 85% of the algal biomass on substrates greater than 6 cm. This pattern of highest autotrophic colonization on larger substrates was consistent with that in Augusta Creek. Based on productivity levels and visual observations, this assemblage at the autotrophic sites was due to algal development.

Since the epilithon standing crops in Augusta Creek riffles were so high compared to the detrital standing crop, total organic weight of the sediments followed the trends of the epilithon community. Detritus averaged 12% of the total particulate organic matter (TPOM), with the percentages ranging from an average of 18% at Smith to 7.5% at Upper 43rd (Table 13). Detrital percentages indicated a greater importance of detritus at Smith and the autotrophic nature of the Upper 43rd and Nagel riffles. This relationship was consistent over the annual period at all sites, although the magnitude of epilithon and detritus estimates varied. The heterotrophic riffle of the west branch of the Clark's Fork of the Yellowstone River, Montana averaged 4.2% non-attached detritus, which indicated the importance of non-photosynthetic epilithon in this system.

Epilithon/detritus ratios (E/D) establish an index of the

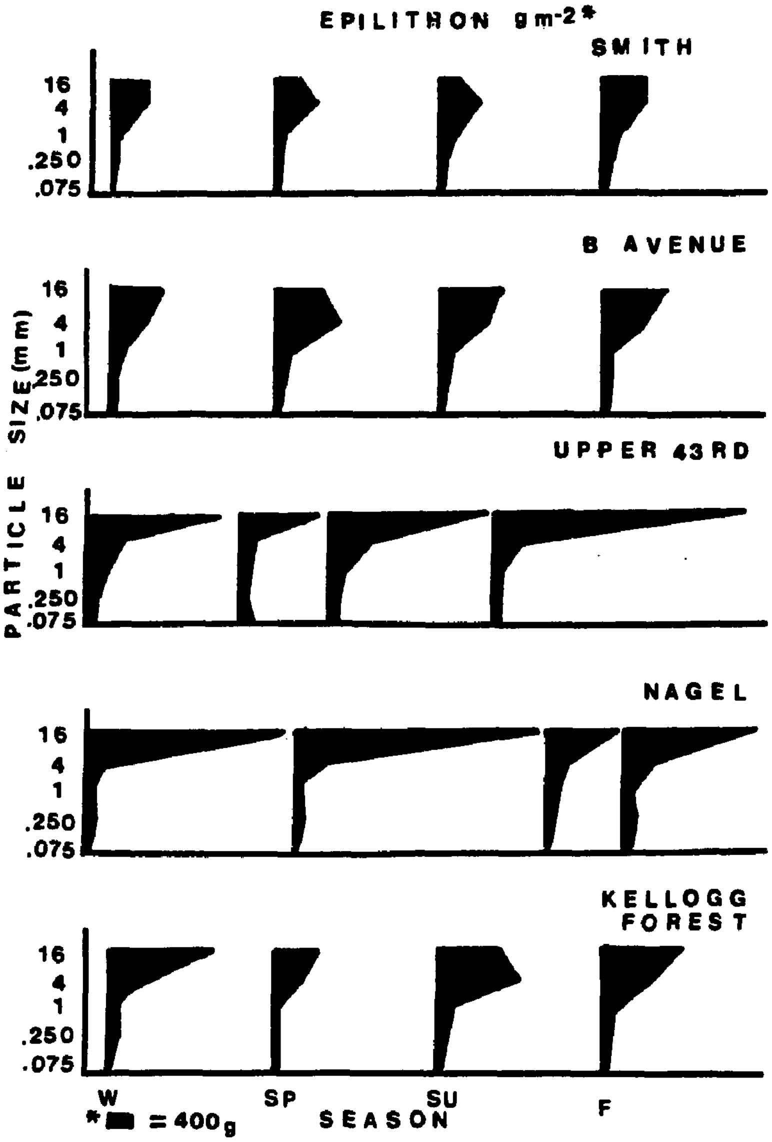


Figure 24. Seasonal distribution of particle-sized epilithon from selected riffle sections of Augusta Creek, Kalamazoo County, Michigan (1974-1975).

Table 13. Percentage of detritus and epilithon and epilithon/detritus (E/D) ratios of sediments from selected sites of Augusta Creek, Kalamazoo County, Michigan.

	WINTER		SPRING		SUMMER		FALL		MEAN ANNUAL		ANNUAL	
Site	% E	% D	% E	% D	% E	% D	% E	% D	% E	% D	range E/D	$\bar{X}$ E/D
Smith	79	21	85	5	82	18	82	18	82	18	3.7-4.8	4.5
B Avenue	92	8	94	5	89	11	79	21	89	11	3.46-16.5	7.9
Upper 43rd	91	9	91	9	92	8	96	4	93	8	10.2-15.0	14.8
Nagel	91	9	94	6	88	12	89	11	91	10	7.5-15.4	12.0
Kellogg Forest	90	10	82	18	92	8	94	6	90	11	4.6-15.8	9.5

relative importance of the two components within riffles. Based on seasonal data, the average E/D for Smith Site was 4.5, B Avenue 7.9, Upper 43rd 14.8, Nagel 12.0, and Kellogg Forest 9.5 (Table 13). The closer the ratio is to one (E = D), the higher the dependence of the riffle section on non-attached detritus versus an epilithon assemblage. Conversely, the larger the ratio, the greater the dependence on the epilithon organic assemblage. The Smith and B Avenue Sites were more dependent on non-attached detritus than the other reaches. Annual average E/D ratios from Augusta Creek sites followed the patterns of average NCP and GCP (Tables 9, 13), which indicated an algal dominance in the epilithon at the autotrophic sites. The summer data from the west branch of the Clark's Fork of the Yellowstone River, Montana averaged 23.6 E/D; this value, higher than the autotrophic Augusta Creek sites, indicated an epilithon based community, although detrital, since levels of NCP and P/R were low. Rocks from this riffle were slippery to the touch during the study period, but not high in algal content. Therefore, the magnitude of this ratio indicates the importance of epilithon versus non-attached detritus within a system, but not the autotrophic-heterotrophic balance within the assemblage.

Seasonal patterns of E/D ratio exhibited no constant pattern except at the Smith Site (Figure 25). The values of approximately five measured at the Smith Site were indicative of consistent dependence on non-attached detritus as an energy base (heterotrophic). The B Avenue Site, indicating a more complex pattern of E/D, was also low in E/D average, similar to Smith Site. A spring increase in epilithon development concomitant with the spring diatom bloom in

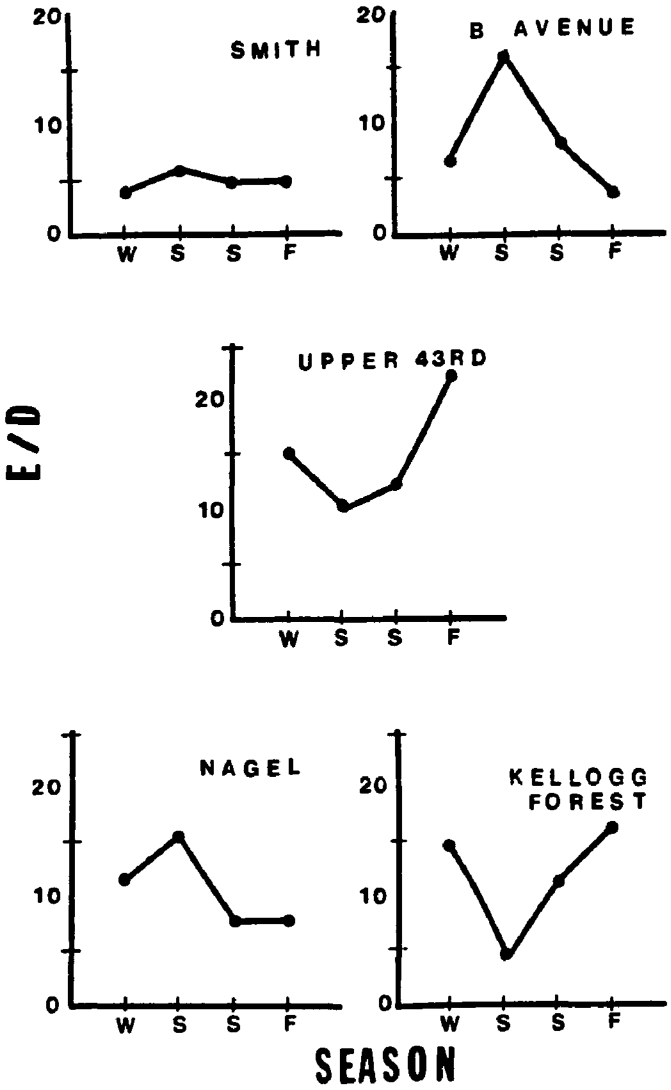


Figure 25. Epilithon/Detritus ratios over an annual period for selected riffle sites of Augusta Creek, Kalamazoo County, Michigan (1974-1975).

Augusta Creek was reflected by an increase in E/D (Figure 25) at the B Avenue Site. The P/R ratio and values of NCP increased at this time as well, which indicated the increase in E/D was of algal origin (Figures 15, 17, 25). The autotrophic sites had an inverse relationship between GCP, NCP, and/or P/R with the E/D ratio. Autotrophic sites remained productive, but as epilithon increased, rates of primary productivity decreased or remained stable at all three sites. This pattern follows the generally accepted trend of decreased rates of primary productivity with periphyton assemblage build-up caused by self-shading and competition for light, carbon dioxide, and nutrients (Goldman 1964, Hynes 1970, Wetzel 1975a).

When one observes riffles within the deciduous biome it is generally the inorganic sediments which predominate and are the major substrates available for colonization, not detritus. Although the scientific literature focuses on water percolation through leaf packs in riffles, a major source of POM might well be the epilithon in many stream riffles. Winterborn et al. (1981) indicated that in New Zealand streams the organic component from inorganic substrates was important to the support of macroinvertebrates and suggested attention be refocused on the organic layer of stones. Therefore, the E/D ratio used with the P/R ratio should be a useful relationship to monitor in ecological investigations involving stream structure and function.

Factors Affecting Rates of Community Metabolism

Although reseachers engaged in monitoring community metabolism may disagree, Lieth (1975) stated that measurement of primary productivity is not in itself a sufficient goal, but should be used as a tool for characterization and interpretation of communities and their relationships to the environment. One needs only to scan the periphyton primary productivity literature to note investigations of regulatory factors on rates of community metabolism and contributions of the autotrophs to community structure and function. Most work has been completed in marine and freshwater lentic systems and includes investigations relating physical and chemical parameters to community metabolism of benthic communities from tidal flats (Pamatmat 1968, Ganning and Wulff 1970, Gargas 1970, Gallagher and Daiber 1973, Littler 1973, Cadeé and Hegeman 1974), freshwater littoral zones (Felföldy 1961, Wetzel 1963, Hargrave 1969a, Hunding 1971, Hunding and Hargrave 1973, Schindler et al. 1973), experimental systems (Odum and Hoskin 1957, Felföldy 1961, Whitford and Schumacher 1961, 1964, Beyers 1962, McIntire et al. 1964, McIntire and Phinney 1965, Kevern and Ball 1965, Lester et al. 1974, Edberg and Hofsten 1973, Pfeifer and McDiffett 1975) and in lotic systems (McConnell and Sigler 1959, Kobayasi 1961, Cushing 1967, Stockner 1968, Brehmer et al. 1969, Hall 1972, Cole 1973, Ertl and Tomajka 1973, Profet and Ransom 1974, Marker 1976b, Pennak and Lavelle 1979, Sumner and Fisher 1979, Gregory 1980). Upstream-downstream techniques were mainly used prior to the collection of data for the present study (1973-1975). The most frequently examined parameters were light and temperature, but included chlorophyll content or AFDW of periphyton, current, organic content of sediments, nutrients, and recently grazing (Hunter 1980, Gregory 1980, Kesler 1981).

In the present study, parameters examined in relation to NCP, GCP, CR, and NDM included stream order, temperature, light, and AFDW of the sediments (detrital, epilithon and total). Cusing (1967) studied many parameters over an annual period from periphyton communitites developed on artificial substrates, but none of the above studies reported in situ data for as extensive a set of parameters over an extended period. Regression analyses were completed for each parameter listed above against each dependent variable (NCP, GCP, CR, NDM) on an annual average basis, as well as by site. Individual half-hour rates of NCP and CR (parameters measured directly in the field) were matched with corresponding light and temperature intervals and run individually and together in multiple regression. The independent variables are discussed separately, but a summary of the regressions is available in Appendix E.

Stream Order

The order system, as defined by Strahler (1957) classifies streams on a physical basis and is convenient for comparison of data particularly within a given watershed. Hynes (1970) suggested heavier usage of this format for characterization of streams. Investigators have begun to relate results on an order basis. Cummins (1974, 1975b, 1977) and Vannote et al. (1980) related various components of stream community structure and function to an order scale. Mahan (1980) found a relationship between amounts of CPOM input to woodland streams, Naiman and Sedell (1979a) investigated benthic organic matter on an order basis and Seyfer and Wilhm (1977) found relationships between periphyton species composition, diversity, and biomass to be a function of stream order.

Regressions with stream order as the independent variable indicated a significant ($P < 0.01$) positive relationship for all parameters with n = ~100 for each case (Appendix E; Table 14). Multiple correlation coefficients (R) ranged from 0.52 for CR to 0.74 for NCP, and F ratios (test for significance=1; higher, more significant) were high especially for GCP and NCP (Table 14; Appendix E). The correlation between stream order and each dependent variable was always highest, which indicates the importance of geomorphology on the functional aspects of stream communities. It is intuitive that as streams widen they receive more light and higher rates of primary productivity would result unless factors such as turbidity, or chemical/physical perturbations were involved. NCP and GCP had the highest F ratios (Table 14), which would be most directly related to light. Rates of CR, although significant, were least affected by stream order, and illustrated a lesser dependence on location (i.e. light availability) than the photosynthetic processes and a heterotroph dominated CR. NDM, influenced by rates of CR, had a lower F ratio, but still indicated a strong relationship with order (F = 74; Table 14).

Light

Various authors have eluded to the importance of light on aquatic primary productivity in the field (Butcher et al. 1930, Calvert 1933, McConnell and Sigler 1959, Profet and Ransom 1974, Sumner and Fisher 1979, Hornick et al. 1981), but few studies have carefully examined the relationship (Kobayasi 1961, Stockner 1968, Hunding 1971, Cadeé and Hegeman 1974).

Marker (1976b), using Tygon cloth to shade chambers (9,000 lux

Table 14. Summary of regression data for various dependent variables and the independent variable stream order for all sites of Augusta Creek, Kalamazoo County, Michigan.

Dependent Variable	N*	R**	F Ratio	P***
$\bar{X}$ GCP	101	0.72	108.1	<0.001
$\bar{X}$ NCP	103	0.74	121.9	<0.001
$\bar{X}$ CR	104	0.52	37.5	<0.001
$\bar{X}$ NDM	101	0.66	74.2	<0.001

* = Number of values

** = Multiple Correlation Coefficient

*** = Level of Significance

versus 27,000 lux lighted) illustrated a 30% decrease in primary productivity. Gregory (1980) artificially lighted a section of a wooded stream (10,000 lux) and significantly increased productivity of a riffle section. The effects of clear cutting and channelization on photosynthesis have been shown by Gelroth and Marzolf (1978) and Gregory (1980). Pennak and Lavelle (1979), studying in situ NCP in mountain stream riffles, found no correlation between NCP and light intensity, but the results were probably influenced by very low periphyton standing crops.

Regression analyses from Augusta Creek communities indicated light was the second most important parameter affecting individual NCP and average GCP, NCP, and NDM; outranked only by stream order (Table 15; Appendix E). F ratios and R values were high and significant in all cases ($P < 0.05$; Table 15). Average data ($n = \sim 100$) with correlation coefficients ranging from 0.52 to 0.57 and F ratios ranging from 36 to 46, indicated the importance of light on levels of GCP, NCP, and NDM within the Augusta Creek drainage, GCP had the highest R (0.57) and F ratio (46.0), but all were similar (Appendix E; Table 15). When individual measures of NCP were used in regression analyses ($n = 666$ and $R = 0.6$ with a high level of significance; Table 15) and when multiple regression with temperature and light was completed (Table 16) $R = 0.6$ with light R value = 0.597 and temperature 0.005. The Augusta Creek correlation coefficient for light and NCP, although lower than those of Cushing (1967) and Stockner (1968) for lotic periphyton communities ($R=0.8$), included values from heterotrophic as well as autotrophic sites. Pamatmat (1968) and Gargas (1970) cited light as the most important factor

Table 15. Summary of regression analyses involving various dependent variables and the independent variable light at five sites from Augusta Creek, Kalamazoo County, Michigan.

Dependent Variable	N*	R**	F Ratio	P***
Individual - NCP	666	0.60	1089.7	<0.001
$\bar{X}$ GCP	100	0.57	46.0	<0.001
$\bar{X}$ NCP	101	0.52	36.0	<0.001
$\bar{X}$ NDM	100	0.53	39.2	<0.001
SMITH				
X GCP	12	0.26	0.695	0.424
X NCP	12	0.27	0.786	0.396
X NDM	12	0.23	0.573	0.467
B AVENUE				
X GCP	33	0.07	0.162	0.690
X NCP	33	0.16	0.812	0.374
X NDM	33	0.23	0.573	0.467
UPPER 43RD				
X GCP	10	0.48	2.444	0.157
X NCP	10	0.41	1.569	0.246
X NDM	10	0.61	4.713	0.062
NAGEL				
X GCP	34	0.38	5.496	0.025
X NCP	35	0.24	2.035	0.163
X NDM	34	0.26	2.373	0.133
KELLOGG FOREST				
X GCP	11	0.53	3.533	0.093
X NCP	11	0.42	1.984	0.193
X NDM	11	0.64	6.146	0.035

* N = number of values,

** R = Multiple Correlation Coefficient

*** P = Level of Significance

Table 16. Summary of multiple regressions involving the effects of temperature and light on individual rates of NCP and CR from all sites of Augusta Creek, Kalamazoo County, Michigan.

Dependent Variable	N*	R**	F Ratio	P***
Individual NCP				
T + L	1957	0.598	544.6	<0.001
L only	1957	0.597		
T only	1957	0.005		
Individual CR				
T + L	1189	0.523	447.1	<0.001
L only	1189	0.241		
T only	1189	0.425		

* N = number of values

** R = Multiple Correlation Coefficient

*** P = level of Significance

influencing community metabolism of marine microbenthos (F ratios = 72-98), as did Littler (1973) in coral reef communities, and Hunding and Hargrave (1973) in freshwater littoral zones.

The sites trend in F ratios reflected productive capacity. Lower values were from Smith and B Avenue, while the Upper 43rd, Nagel and Kellogg Forest F ratios were greater than one, however, on a site basis values were not significant in most casts (Table 15). At autotrophic based sites the effects of light were greater on GCP and NDM than NCP (Table 15). Values of GCP and NDM were calculated using estimates of CR; one is a positive influence (GCP) while the other is negative (NDM) and both increased, which indicates some unmeasured parameter such as grazing losses may have been involved. Kesler (1981) reported Chironomus scutellaria may consume 3 to 70% of the NCP, while Hunt (1980) and Gregory (1980) found that snails could effectively reduce periphyton communities. Populations of grazer organisms, including Hydroptila, Neophylax, Glossosoma, Helicopsyche (Trichoptera:caddisflies), Stenonema (Ephemeroptera:mayflies), Psephenus (Coleoptera:beetles) and Ferrissia (Gastropoda:snails) were common, especially at the Nagel Site and observations of grazing rates by D. Hart (personal communication, Kellogg Biological Station) indicated active cropping of periphyton at the Nagel Site.

The relationship between light intensity and rates of photosynthesis is not linear over a large range of light values. Light saturation and photoinhibition often occur at higher light intensities in phytoplankton communities (Ryther 1956a, Verduin 1956, Pamatmat 1968, Marker 1976b, Ganning and Wulff 1970. Light saturation occurred at approximately 20,000 lux for combined sites of Augusta

Creek (Appendix F; Figure F - 1). Except for Smith Site, saturation ranges were very similar: B Avenue (n=677) 20,000 lux, Upper 43rd (n=220) 24,000 lux, Nagel (n=571) 15,000 to 20,000 lux, and Kellogg Forest (n=242) 18,000 to 20,000 lux (Figures F 1-6). Rates of NCP, and likely algal standing crops, were very low at the Smith Site and few measurements of NCP were made above 20,000 lux (Figure F - 2), therefore, resolution of light saturated photosynthesis was not possible. These saturation levels are within the range reported for marine phytoplankton (5,000 to 30,000 lux; Ryther 1956a), and lentic benthic algae (10,000 to 12,000 lux; Hunding 1971, Lester et al. 1974, Colijn and Buurt 1975), and natural and artificial streams (4,000 to 62,000 lux; Kobayasi 1961, McIntire et al. 1964).

Photoinhibition was not observed at any of the sites (Figures F 2-6), which was not surprising, as it has not been reported in lentic periphyton communities (Pamatmat 1968, Ganning and Wulff 1970, Hunding 1971, Gallagher and Daiber 1973, Littler 1973, Cadeé and Hegeman 1974, Colijn and Buurt 1975). In artificial stream developed periphyton communities, McIntire et al. (1964) and McIntire and Phinney (1965) found no photoinhibition and Marker (1976b) noted no photoinhibition from an <u>in situ</u> study. The large number of <u>in situ</u> cases examined from autotrophic and heterotrophic sites in the Augusta Creek watershed reinforced these noted examples.

The effects of temperature on light saturated photosynthesis are illustrated in Appendix F (Figures F 7-11). The most linear of these plots (0 - 5 C) indicated light saturation at 18,000 lux (Figure F - 7, n=414). At temperature intervals 5 to 10 C, 10 to 15 C, 15 to 20 C, and 20 to 25 C light saturation occurred between 20,000 to 25,000 lux (Figures F 8-11). Kobayasi (1961) found seasonal shifts in light saturation from 8000 lux in a winter diatom community to 15,000 lux in the summer *Cladophora* dominated community. As indicated by Ryther (1956a) light saturation levels vary for various algal taxa, and the shift observed by Kobayasi (1961) and the slight increase at 15 - 20 C (Figure F-10) at Augusta Creek sites may have been due to changes in species composition rather than temperature. The influence of temperature on photosynthetic activity, studied by Rabinowich (1951) and Jørgensen and Steemann Nielsen (1965, 1968), discussed in McIntire et al. (1964) and Hunding (1971), indicated the rapid increase portion of the activity curve to be due to photochemical processes independent of temperature, while the saturated portion of the curve fluctuated depending on temperature effects on the photosynthetic enzymes. Although rates of NCP increased with temperature, similar levels of light saturation were indicated over the temperature range naturally encountered by Augusta Creek communities (0 - 25 C) and illustrated the complexity of photosynthetic responses to more than one variable. Light was the primary factor regulating primary productivity in woodland streams and based on light-saturated photosynthesis levels and average daily light of 12,000 to 13,000 lux, amounts of NCP at Smith and B Avenue would be limited. Reduced levels of NCP were documented by *in situ* measurements at these two sites compared to the open and shaded larger order study reaches (Figure 15).

Temperature

The effects of temperature on organisms and metabolic processes have been extensively investigated, and Q_{10} values have been calculated for process of organisms from bacteria to mammals. The relationship between temperature and community metabolism in streams, however, has not received much attention. In aquatic systems the effects of temperature on CR was investigated in marine tidal flats (Pamatmat 1968, Gallagher and Daiber 1973, Cadeé and Hegeman 1974), and freshwater littoral zones (Hargrave 1969a, 1969b; Edberg and Hofsten 1973) with all investigators reporting temperature to be an important controlling factor. The effects of temperature on community productivity have been studied, but mainly in lentic systems where a positive correlation has been indicated, but of lesser importance than the effects of light (Gargas 1970, Hunding 1971, Adams and Stone 1973, Ertl and Tomajka 1973, Gallagher and Daiber 1973, Cadeé and Hegeman 1974, Colijn and Buurt 1975).

The average data (n=100) indicated a positive relationship between temperature and all parameters with R values ranging from 0.64 for CR to 0.33 for NCP and F ratios of 12 to 70 (Appendix E; Table 17). These values were generally lower than the values for light, but still significant at the P=0.01 level (Tables 15, 17). While CR had the lowest correlation with light, it was most strongly correlated with temperature. Hargrave (1969b), Ertl and Tomajka (1973), and Cadeé and Hegeman (1974) reported positive correlations between levels of GPP and temperature in lentic systems. The R of 0.5 for temperature and GPP from intertidal flats of the Wadden Sea was similar to the 0.41 R for GCP and temperature from Augusta Creek sites (Table 17).

Individual rates of NCP (n=1957) indicated a significant correlation with temperature (R = 0.18; F ratio = 67.1). However,

Table 17. Summary of regressions involving the effects of temperature on NCP, GCP, CR, and NDM from various sites of Augusta Creek, Kalamazoo County, Michigan.

Dependent Variable	N*	R**	F Ratio	P***
Individual - NCP	1957	0.182	67.1	<0.001
Individual - CR	1189	0.523	447.1	<0.001
X GCP	100	0.414	20.3	<0.001
X NCP	102	0.328	12.0	0.001
X CR	103	0.640	70.0	<0.001
X NDM	100	0.339	12.7	0.001
SMITH				
X GCP	12	0.022	0.005	0.946
X NCP	12	0.0003	0.000	0.999
X CR	12	0.013	0.002	0.968
X NDM	12	0.133	0.180	0.680
B AVENUE				
X GCP	34	0.600	17.8	<0.001
X NCP	35	0.047	0.07	0.790
X CR	34	0.785	51.2	<0.001
X NDM	34	0.368	5.00	0.032
UPPER 43RD				
X GCP	10	0.677	6.7	0.032
X NCP	10	0.547	3.4	0.102
X CR	11	0.898	37.6	<0.001
X NDM	10	0.519	2.9	0.125
NAGEL				
X GCP	34	0.529	12.4	0.001
X NCP	35	0.377	5.5	0.026
X CR	34	0.742	39.3	<0.001
X NDM	34	0.263	2.3	0.133
KELLOGG FOREST				
X GCP	10	0.660	6.2	0.038
X NCP	10	0.361	1.2	0.305
X CR	12	0.765	14.1	0.004

* N = number of values

** R = Multiple Correlation Coefficient

*** P = Level of Significance

this was much less than the regression with light (R = 0.06; F ratio = 4089.7). Individual rates of CR (n=1189) had an R value of 0.52 and F ratio of 447.1, which indicated a highly significant relationship (Table 17). When run with light in multiple regression, temperature had an R = 0.43 in contrast to R = 0.24 for light (Table 16). Together (n=1968), or on a site basis, there was no evident relationship between NCP and temperature (Figures G 7-12).

Considering the 1189 points in Figure G - 1, rates of CR generally increased linearly with increasing temperature, especially if data from Smith and B Avenue Sites are omitted. Both of these sites showed constant CR regardless of temperature (Figures G-2, G-3). The lack of correlation between temperature and CR at Smith Site was evident from the regression analyses (Table 17). Assuming that these communities are heterotrophic, one would expect CR to increase with temperature as reported for bacteria (Brock 1966). The consistency noted at the first order sites was related to the comparatively low epilithon standing crops. Beyers (1962) recorded that in experimental microcosms temperature affected CR until a balanced ecosystem had developed. He related this to the multiciplicity of metabolic pathways at work within the community, which easily adapted to changing conditions. Therefore, the consistency may be related to establishment of a dynamic equilibrium as rates of CR varied little over the seasons.

At the open Upper 43rd and Nagel sites with well developed epilithic communities, a direct relationship existed with temperature (Figures G-4, G-5). Levels of CR correlated with epilithon development, ranking from low to highest rates and development:

Smith, B Avenue, Kellogg Forest and Nagel (Kellogg Forest = Nagel) (Table 9). Although temperature was important in controlling rates of CR, a community must be present to respire, and at Smith Site low CR indicated low microbial development.

On a site basis a significant relationship with temperature was not evident for any parameter measured at Smith Site, while at B Avenue CR, GCP and NDM were correlated with temperature (Appendix E, Table 17). Cooler temperatures probably influenced algal development at these sites (Smith $\bar{x}$ 9.5 C, B Avenue $\bar{x}$ 8.7 C), but temperature ranges (0 - 25 C) included periods in which diatom growth abounded (Table 10). The higher temperatures occurred during maximum canopy cover, therefore, complicating interpretation of development patterns. Diatoms were visually present at B Avenue, and GCP and NDM were correlated with temperature at this site.

At the Nagel, Upper 43rd, and Kellogg Forest sites, CR was again the most obviously correlated parameter with temperature; GCP was the only other significantly correlated parameter ($P = 0.05$; Appendix E; Table 17). NCP levels were more positively influenced by temperature at these open sites (Figures G 10 - 12), as indicated by increased R values and F ratios (Table 17). This relationship indicated that temperature may have been limiting epilithon development at the shaded first order sites when light was available for increased levels of primary productivity. Adams and Stone (1973) reported seasonal differences in NCP of Cladophora to be closely related to temperatures. The importance of temperature on rates of CR, GCP, and NDM, possibly through CR mediation on GCP and NDM, or some unknown influence such as community composition and species temperature optima, or total epilithon development and stability was evident at sites of Augusta Creek.

Detrital-Ash-Free Dry Weight

The question of the effects of detrital standing crops on CR of communities has been addressed in lentic and lotic systems (Nelson and Scott 1962, Hargrave 1969b, Edberg and Hofsten 1973, Göthberg and Karlström 1975). Studies relating productivity to AFDW of detritus have not been reported.

The high values of P make it evident that detritus had little effect on community metabolism at sites of Augusta Creek (Table 18). Few of the F ratios were greater than one, which also indicated there was little influence on average rates or on an individual site basis (Table 18; Appendix E). These ratios ranged from 0.01 for average GCP to 1.3 for average NDM and on a site basis from 0.02 for NCP at B Avenue to 3.24 for CR at the Nagel Site. There were no clear patterns established as values greater than one were for different parameters. The correlations between parameters and detritus were weak, and measurement of detrital standing crop was not of value in predicting rates of community metabolism at riffle sites of Augusta Creek.

Epilithon

Epilithon has been characterized in the literature mainly by estimates of biomass obtained from chlorophyll extraction (McConnell and Sigler 1956, Wetzel 1963, Duffer and Dorris 1966, Grzenda et al. 1968, Bowbówna 1972, Cadée and Hegeman 1974, Helan et al. 1977, Seyfer and Wilhm 1977, Sumner and Fisher 1979, Bush and Fisher 1981). Dry weight and AFDW determinations on artificial substrates have also been

Table 18. Regression summary for the relationship between GCP, NCP, CR, and NDM and the independent variable detrital standing crop (AFDW) for five sites of Augusta Creek, Kalamazoo County, Michigan.

Dependent Variable	N*	R**	F Ratio	P***
X GCP	94	0.10	0.012	0.900
X NCP	96	0.11	1.300	0.255
X CR	96	0.08	0.600	0.435
X NDM	94	0.12	1.400	0.244
SMITH				
X GCP	12	0.32	1.112	0.316
X NCP	12	0.13	0.175	0.694
X CR	12	0.35	1.434	0.259
X NDM	12	0.32	1.126	0.314
B AVENUE				
X GCP	29	0.12	0.372	0.547
X NCP	30	0.02	0.016	0.900
X CR	29	0.17	0.826	0.372
X NDM	29	0.18	0.917	0.347
UPPER 43RD				
X GCP	10	0.14	0.149	0.710
X NCP	10	0.28	0.687	0.431
X CR	11	0.19	0.351	0.568
X NDM	10	0.34	1.045	0.333
NAGEL				
X GCP	32	0.25	2.062	0.161
X NCP	33	0.18	1.031	0.318
X CR	33	0.31	3.243	0.081
X NDM	32	0.13	0.524	0.475
KELLOGG FOREST				
X GCP	11	0.23	0.478	0.507
X NCP	11	0.27	0.711	0.421
X CR	11	0.06	0.029	0.869
X NDM	11	0.47	2.598	0.141

* N = number of values

** R = Multiple Correlation Coefficient

*** P = Level of Significance

used (Cushing 1967, Edberg and Hofsten 1973, Helan et al. 1973, Calow 1975, Naiman 1976, Seyfer and Wilhm 1977). These above studies indicated variable correlation between biomass and community metabolism. However, these studies were aimed at determining autotrophic colonization rather than the entire assemblage including detritus. Madsen (1972) found the epilithon of shaded Denmark streams to be detrital dominated, and Calow (1975) found epilithic detritus to be a high quality food for macroinvertebrates. Perkins and Kaplen (1978), reported epilithon to be 76% detritus and further characterized this segment to be accumulated autochthonously produced diatom stalks. Clearly, detritus is a portion of the epilithon and will be involved in any in situ measurements of community metabolism and the impact of the intact assemblage is of importance in the function of stream ecosystems regardless of the composition.

On an annual average basis, a significant positive relationship existed between epilithon development and all dependent variables (Table 19). F ratios ranged from 7.8 for NDM to 17.6 for NCP (Table 19). The F ratios for epilithon followed stream order and light in order of magnitude (Appendix E); these values were much more significant than estimates of detrital AFDW. Correlations ranging from R = 0.28 to 0.8 have been reported for biomass and primary productivity (Cadeé and Hegeman 1974, Ertl and Tomajka 1973). Augusta Creek values of R = 0.42 NCP and R = 0.39 GCP (Table 19) are within this range. Various relationships have been demonstrated using chlorophyll a extractions as an estimator of biomass (Wetzel 1963, Schindler et al. 1973, Sumner and Fisher 1975, Marker 1976b, de laCruz and Post 1977, Bush and Fisher 1981). While chlorophyll estimates may

Table 19. Regression summary for the relationship between NCP, GCP, CR, and NDM with the independent variable epilithon for five sites of Augusta Creek, Kalamazoo County, Michigan.

Dependent Variable	N*	R**	F Ratio	P***
$\bar{X}$ GCP	83	0.39	14.8	0.002
$\bar{X}$ NCP	85	0.42	17.6	0.000
$\bar{X}$ CR	85	0.31	8.6	0.004
$\bar{X}$ NDM	83	0.30	7.8	0.007
SMITH				
$\bar{X}$ GCP	12	0.41	1.966	0.191
$\bar{X}$ NCP	12	0.76	13.601	0.004
$\bar{X}$ CR	12	0.38	1.699	0.222
$\bar{X}$ NDM	12	0.66	7.696	0.020
B AVENUE				
$\bar{X}$ GCP	23	0.24	1.270	0.273
$\bar{X}$ NCP	24	0.21	0.979	0.333
$\bar{X}$ CR	23	0.19	0.796	0.382
$\bar{X}$ NDM	23	0.10	0.215	0.648
UPPER 43RD				
$\bar{X}$ GCP	9	0.00	0.000	0.992
$\bar{X}$ NCP	9	0.03	0.007	0.935
$\bar{X}$ CR	10	0.16	0.206	0.662
$\bar{X}$ NDM	9	0.37	1.126	0.324
NAGEL				
$\bar{X}$ GCP	28	0.07	0.113	0.740
$\bar{X}$ NCP	29	0.08	0.189	0.667
$\bar{X}$ CR	29	0.20	1.104	0.303
$\bar{X}$ NDM	28	0.18	0.881	0.357
KELLOGG FOREST				
$\bar{X}$ GCP	11	0.19	0.321	0.585
$\bar{X}$ NCP	11	0.38	1.523	0.248
$\bar{X}$ CR	11	0.17	0.260	0.622
$\bar{X}$ NDM	11	0.63	6.254	0.034

* N = number of values

** R = Multiple Correlation Coefficient

*** P = Level of Significance

reflect productivity changes, using epiliton estimates the entire community is included and integrated.

The effects of epilithon development on CR and NDM have not been examined by many investigators. However, Bush and Fisher (1981) reported increased CR with increased biomass in a desert stream (Arizona). The relationships indicated by regressions from Augusta Creek riffles were not high, but ranked above detrital standing crop estimates (Table 19). For individual sites several F values were greater than one, but few regressions were significant ($P = 0.05$). This indicates a stabilization in epilithon development at a site, with site differences reflected in the average epilithon and metabolic capacities. Dynamic changes in biomass per day would not be expected dealing with large initial epilithon weights (compared to cell or detrital weights). Rates of metabolism oscillated with changes in physical factors, therefore, only when averaged over the annual period would these correlations become obvious. Average integration is further supported by the higher correlations at Smith site where epilithon levels were lower and changes were more readily detected.

Sites

Examining the regression data (Appendix E) for each dependent variable stream order was the most important factor influencing community metabolism. Of the variable parameters light was by far the most important parameter for all facets of community metabolism except CR where temperature was most important.

At the sites controlling factors varied (Table E - 3). The highest and only significant correlation and F ratio was epilithon at the Smith Site, which illustrates the importance of even small amounts of detrital or algal accumulation. At the B Avenue Site the only significant relationships were with temperature for CR, GCP, and NDM, which indicated a bacterial dominated community. Upper 43rd Site had significant correlations between GCP and CR with temperature, Nagel had temperature correlating with NCP, CR, GCP and NDM and light with GCP, while the Kellogg Forest had significant regressions for GCP, CR, and temperature and NDM with light and epilithon. Temperature on a site basis was the influencing factor on average rates of community metabolism and only when individual rates were examined was the overwhelming importance of light evident.

Particle-Size Community Metabolism

The impact of various inorganic and organic particle-size distributions within sediments on community metabolism in lotic systems has received little attention (Minshall et al. 1982). McConnell and Sigler (1959) and Marker (1976b) indicated that the larger inorganic particles contained approximately 95% of the algal biomass based on chlorophyll extractions, which indicated larger particles more suitable for algal colonization. Nelson and Scott (1962) studying CR rates in various sections of the Oconee River, Georgia, using the upstream-downstream technique, found CR to be insignificant on shifting sand substrates. This technique does not allow separation of discrete particle-sizes or detritus from inorganic sediments.

Electron and epiflouresence microscopy of epilithon of small stones indicated a prevalence of detritus (Madsen 1972) and Suberkropp and Klug (1974) illustrated that as detrital particles decreased in size the major colonization shifts from fungal hyphae to bacteria. In their micrographs algae (diatoms) were also present. It is of both theoretical and applied interest to examine the metabolism of various sediment particle-sizes and their contribution to total community metabolism.

The activity on an AFDW basis ($\mu l O_2$ g^{-1}) of various particle sizes may be compared and when converted to g O_2 $m^{-2}d^{-1}$ the relative contribution of particles to overall community metabolism can be partitioned and the trends compared to in situ measurememnts (Appendix H). Comparisons of Gilson metabolism estimates to in situ rates of NCP, GCP and CR m^{-2} indicated parameters to generally be greater when estimated by the former method (Table 20). This trend, especially for macroinvertebrate-free sediments, may indicate the inadequacy of short term estimates, extrapolation to an areal basis assuming all layers of epilithon metabolize at equal rates, particle-sizing and assuming all particles behave the same in situ where depth of the particle would be of importance, or exposure through particle-sizing of surfaces to higher oxygen concentrations with subsequent increased activity of the flora, especially facultative anaerobes. However, the Gilson estimates are of value for comparative purposes and particle-size analyses.

Particle-sized estimates of community metabolism (AFDW basis)

NCP for detritus ranged from -319.7 $\mu l O_2$ $g^{-1}h^{-1}$ at B Avenue in August to +1687.6 $\mu l O_2$ $g^{-1}h^{-1}$ at Upper 43rd in June; 0.45 μm particles were always most active (Table H-1; Figures 26, 27). Annual averages

Table 20. Comparison of community metabolism parameters from *in situ* and Gilson Respirometer experiments from five riffle communities of Augusta Creek, Kalamazoo County, Michigan.

Parameter	Site	Annual $\overline{X}$ Gilson $g\ O_2\ m^{-2}d^{-1}$	Annual $\overline{X}$ *in situ* $g\ 0^2\ m^{-2}d^{-1}$
NCP	Smith	-0.79	-0.16
NCP	B Avenue	-1.43	-0.02
NCP	Upper 43rd	5.46	1.24
NCP	Nagel	2.77	1.80
NCP	Kellogg Forest	1.39	0.94
GCP	Smith	-0.08	0.12
GCP	B Avenue	0.28	0.26
GCP	Upper 43rd	6.83	2.18
GCP	Nagel	4.53	2.89
GCP	Kellogg Forest	3.01	1.36
CR	Smith	1.24	0.56
CR	B Avenue	2.87	0.53
CR	Upper 43rd	2.27	1.79
CR	Nagel	2.93	1.88
CR	Kellogg Forest	2.84	0.75
NDM	Smith	-1.32	-0.44
NDM	B Avenue	-2.59	-0.26
NDM	Upper 43rd	4.55	0.45
NDM	Nagel	6.60	1.01
NDM	Kellogg Forest	0.17	0.60

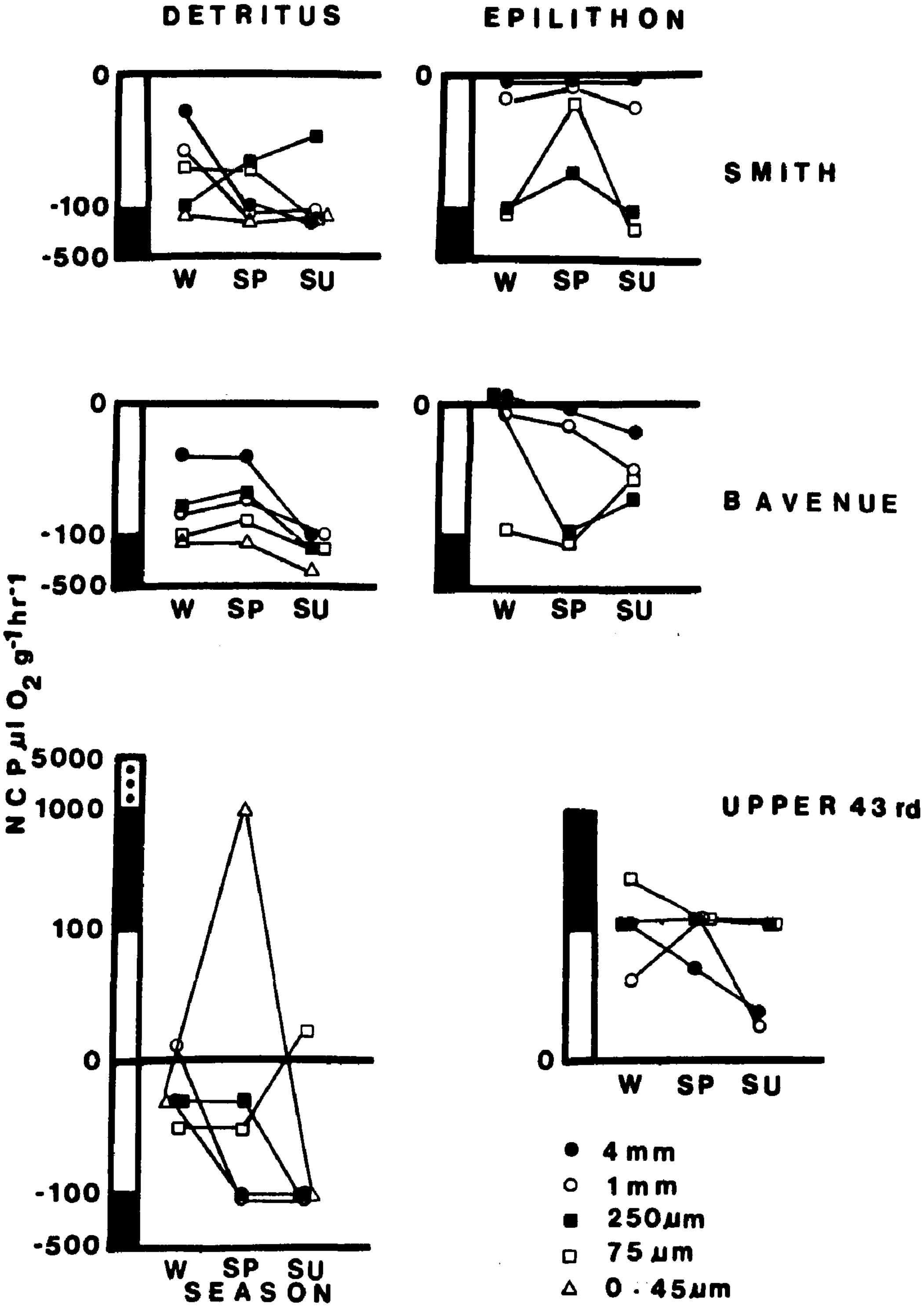


Figure 26. Estimates of NCP from particle sized detritus and epilithon communities from Smith, B Avenue and Upper 43rd riffle sites of Augusta Creek, Kalamazoo County, Michigan (1974-1975).

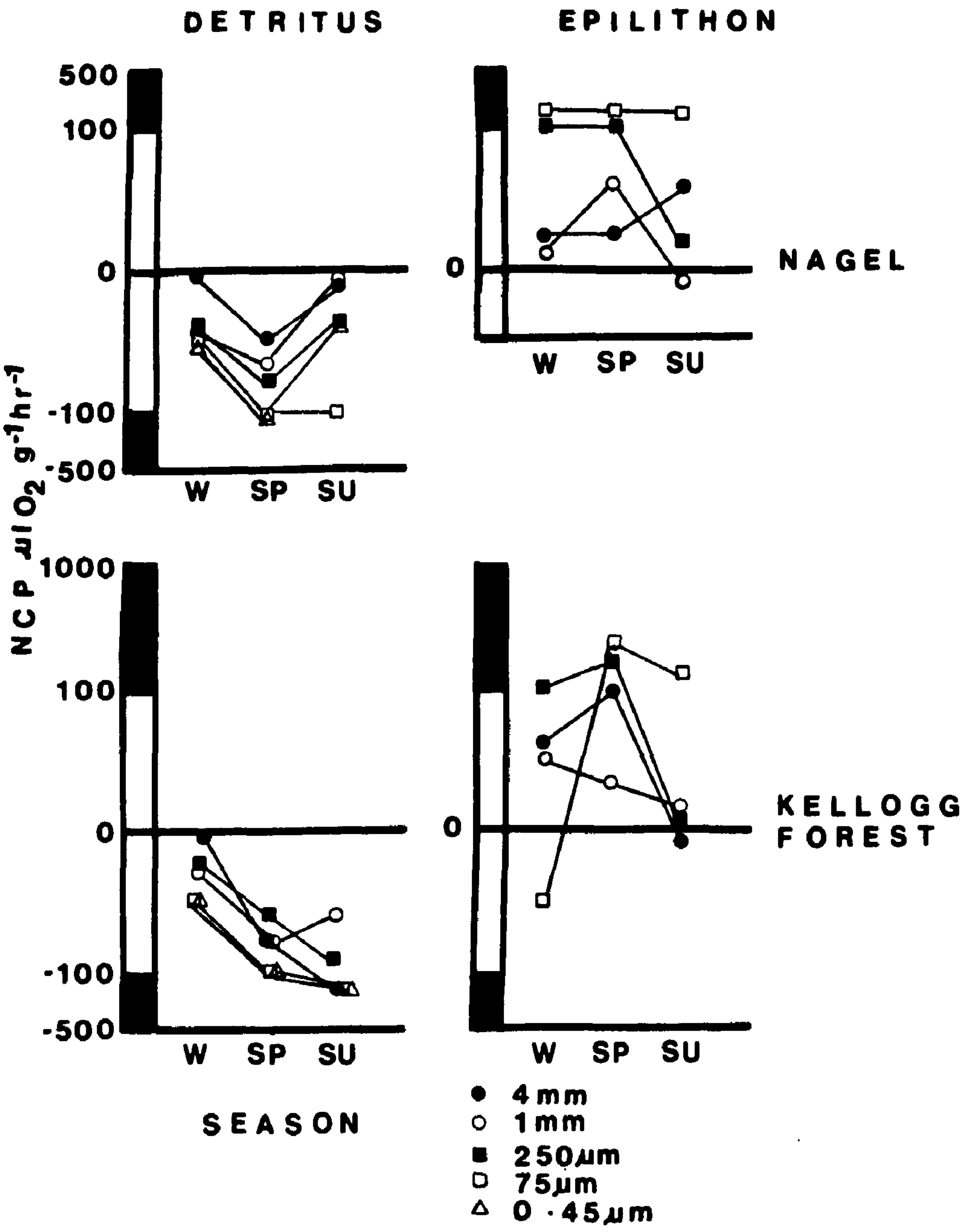


Figure 27. Estimates of NCP from particle-sized detritus and epilithon communities from Nagel and Kellogg Forest riffle sites of Augusta Creek, Kalamazoo County, Michigan (1974-1975).

for particle-sizes ranged from -213.3 to +485.3 $\mu l O_2\ g^{-1} h^{-1}$ at B Avenue and Upper 43rd, respectively (Table 21). The striking featurs of detrital NCP included negative values for the majority of particle sizes during all seasons, with least negative values of NCP generally during the February diatom bloom. The only positive value was during June at the Upper 43rd Site. Similar seasonal trends existed for all sizes within sites (Figures 26, 27). Comparing average rates of NCP between sites, B Avenue and Smith values were consistently more negative than the autotrophic sites (Table 21). Ranking the particles on increasing levels of NCP at each site (Table 22) there were no clear patterns within particle-sizes, but ranked by total average NCP, the 0.45 μm detritus had the only positive value, while the others were similar with the 75 μm, which were lowest in autotrophic colonization (Tables 21, 22).

Estimates of epilithon NCP ranged from -321.0 to +2174.2 $\mu l O_2\ g^{-1} h^{-1}$ for 75 μm mineral sediments in August at Smith and 4 mm sediments in March at the Kellogg Forest Sites, respectively (Appendix H; Figures 26, 27). Averages ranged from -155 $\mu l O_2\ g^{-1} h^{-1}$ for 75 μm particles to +752.9 $\mu l O_2\ g^{-1} h^{-1}$ for 4 mm gravel at Kellogg Forest (Table 21). Based on rates of positive NCP, epilithon of all inorganic fractions at Upper 43rd were colonized by autotrophic organisms during all seasons, as well as the majority of the Nagel and Kellogg Forest particles (Figures 26, 27). Lowest rates of NCP at these sites occurred in August, while maxima were scattered in occurrence (Figures 26, 27). The heterotrophic sites had little algal colonization, but greater NCP occurred on these sediments than the detrital segements, especially in the 4 and 1 mm inorganic fractions.

Table 21. Average particle-sized community metabolism estimates (weight basis) from Gilson Respirometery for five riffle sites of Augusta Creek, Kalamazoo County, Michigan.

Site	4mm	1mm	250µm	75µm	0.45µm	$\bar{x}$ /g
$\bar{X}$ NCP DETRITUS	$\mu lO_2\ g^{-1}h^{-1}$					
Smith	-133.9	- 95.2	- 79.0	-116.3	-159.2	-116.7
B Avenue	- 65.2	- 91.1	-133.0	-130.1	-213.3	-124.5
Upper 43rd	- 88.6	- 83.5	- 50.0	- 25.6	+485.3	+ 47.5
Nagel	- 23.1	- 40.3	- 54.2	- 94.8	- 83.9	- 59.3
Kellogg Forest	-107.4	- 60.1	- 62.6	- 86.4	-114.9	- 86.3
$\bar{X}$	-83.6	- 74.0	- 75.8	- 90.6	17.2	
$\bar{X}$ CR DETRITUS	$\mu lO_2\ g^{-1}h^{-1}$					
Smith	76.5	67.2	42.1	63.0	93.9	68.5
B Avenue	55.1	64.0	94.9	78.5	160.6	90.6
Upper 43rd	140.4	111.9	125.7	129.7	351.0	171.7
Nagel	34.3	34.1	42.0	71.5	157.6	67.9
Kellogg Forest	216.1	124.1	64.3	91.8	262.0	151.7
$\bar{X}$	104.5	80.3	73.8	86.9	205.0	
$\bar{X}$ NCP EPILITHON	$\mu lO_2\ g^{-1}h^{-1}$					
Smith	- 5.5	- 18.7	-123.4	-155.0	------	- 75.7
B Avenue	- 8.3	- 25.5	- 61.4	- 96.3	------	- 47.9
Upper 43rd	116.3	75.1	215.1	386.0	------	198.1
Nagel	35.8	20.0	106.6	205.8	------	92.1
Kellogg Forest	752.9	57.2	124.2	214.6	------	287.2
$\bar{X}$	178.2	21.6	52.2	111.0		
$\bar{X}$ CR EPILITHON	$\mu lO_2\ g^{-1}h^{-1}$					
Smith	10.2	12.1	61.8	38.9	------	43.3
B Avenue	19.3	26.8	74.9	104.0	------	56.3
Upper 43rd	29.0	43.0	83.3	110.3	------	66.4
Nagel	18.4	24.3	48.8	126.9	------	54.6
Kellogg Forest	39.3	35.8	135.3	103.9	------	78.6
$\bar{X}$	38.6	28.4	80.8	90.8		

Table 22. Ranked particle-size contributions to various parameters of community metabolism (weight basis) from five riffle communities of Augusta Creek, Kalamazoo County, Michigan.

Site	Particle size rank - Highest to lowest				
	Rank 1	2	3	4	5
$\bar{X}$ NCP DETRITUS					
Smith	250μm	1mm	75μm	4mm	0.45μm
B Avenue	4mm	1mm	75μm	250μm	0.45μm
Upper 43rd	0.45μm	75μm	250μm	1mm	4mm
Nagel	4mm	1mm	250μm	0.45μm	75μm
Kellogg Forest	1mm	250μm	75μm	4mm	0.45μm
Sites Average	0.45μm	1mm	250μm	4mm	75μm
$\bar{X}$ CR DETRITUS					
Smith	0.45μm	4mm	1mm	75μm	250μm
B Avenue	0.45μm	250μm	75μm	1mm	4mm
Upper 43rd	0.45μm	4mm	75μm	250μm	1mm
Nagel	0.45μm	75μm	250μm	4mm	1mm
Kellogg Forest	0.45μm	4mm	1mm	75μm	250μm
Sites Average	0.45μm	4mm	75μm	1mm	250μm
$\bar{X}$ NCR EPILITHON					
Smith	4mm	1mm	250μm	75μm	------
B Avenue	4mm	1mm	250μm	75μm	------
Upper 43rd	75μm	250μm	4mm	1mm	------
Nagel	75μm	250μm	4mm	1mm	------
Kellogg Forest	4mm	75μm	250μm	1mm	------
Sites Average	4mm	75μm	250μm	1mm	------
$\bar{X}$ CR EPILITHON					
Smith	75μm	250μm	1mm	4mm	------
B Avenue	75μm	250μm	1mm	4mm	------
Upper 43rd	75μm	250μm	1mm	4mm	------
Nagel	75μm	250μm	1mm	4mm	------
Kellogg Forest	250μm	75μm	1mm	4mm	------
Sites Average	75μm	250μm	4mm	1mm	------

Sites ranked by average epilithon NCP in increasing order were: Smith, B Avenue, Nagel, Upper 43rd, and Kellogg Forest (Table 21). Obvious differences were evident between the heterotrophic headwater sites and the open sites of Augusta Creek. Ranked particle-sized epilithon NCP (Table 22) showed variable results with larger sizes autotrophically colonized most heavily at Smith, B Avenue, and Kellogg Forest, while smaller particles at Nagel and Upper 43rd had the highest values of NCP. Averaging sites, the two extremes in particle-size had the highest rates of NCP with 1 mm particles lowest in activity (Table 22). Heaviest autotrophic colonization of larger particles has been shown by other investigators (McConnell and Sigler 1959, Duffer and Dorris 1966, Marker 1976b). Although primary productivity has not been reported on discrete particle sizes in the literature, Gargas (1970) reported the epipsammon to contribute 60 to 83% of the primary production of marine littoral sediments as compared to detritus and noted Gronsted (1960, 1962) found similar results in sediments of the Wadden Sea and Danish fjords. These studies, with autotrophic colonization on fine particles (sands) are similar to the increased levels of NCP on the 75 μm inorganic sediments reported in this study.

Partitioned CR (μlO_2 $g^{-1}h^{-1}$) results for sediments indicated the detrital particles had higher rates of CR than the inorganic sediments. Higher (40 to 90%) detrital than inorganic sediment CR has been reported by Teal (1962) and Hargrave (1972) from lentic systems. The 4 mm and 1 mm inorganic particles from Augusta Creek approximated 35% of the detrital CR, but that of smaller particles (250 andμ75 m) was approximately equal (104 and 109% respectively). As particle-size decreases, surface area to volume increases and floral shifts from fungi to bacteria were noted by Suberkropp and Klug (1974), which may have accounted for increased rates of metabolic activity on the finer particles at Augusta Creek sites. However, Nelson and Scott (1962) found CR to be insignificant on shifting sand bottoms, which indicates a complex relationship between particle-size and CR, dependent on the location and stability of small particles within the sediments. Total inorganic CR averaged 70% of total CR at Augusta Creek riffles.

Detrital CR ranged from 15.1 μlO_1 $g^{-1}h^{-1}$ for 4 mm fractions from Nagel Site in March to 738.8 μlO_2 $g^{-1}h^{-1}$ for 0.45 μm Upper 43rd detritus in June, while particle-size specific CR averaged over the early spring to late summer period ranged from 34 μlO_2 $g^{-1}h^{-1}$ for 4 and 1 mm detritus to 351 μlO_2 $g^{-1}h^{-1}$ for 0.45 μm components, both at Upper 43rd (Appendix H; Table 21). The lowest rates at all sites were during the early spring; they increased during early summer and generally attained maxima in late summer (Figure 28). The ultrafine particulate organic matter (0.45 μm category = UPOM) rates of CR were consistently highest at all sites with most other particles similar and lower in rates of CR (Figure 28). The highest average rates were from Upper 43rd detritus followed by Kellogg Forest, B Avenue, Smith and Nagel (Table 21). The average activity by particle size (Table 22) indicated 0.45 μm detrital particles had the highest rates of CR followed by 4 mm particles with 75 μm, 1 mm, and 250 μm detrital particles similar. These data are unlike those of Fenchel (1970) and Hargrave (1972) who found detritus CR rates inversely related to particle size. Based on surface to volume ratios of particles an inverse relationship may be expected, however, this premise would be

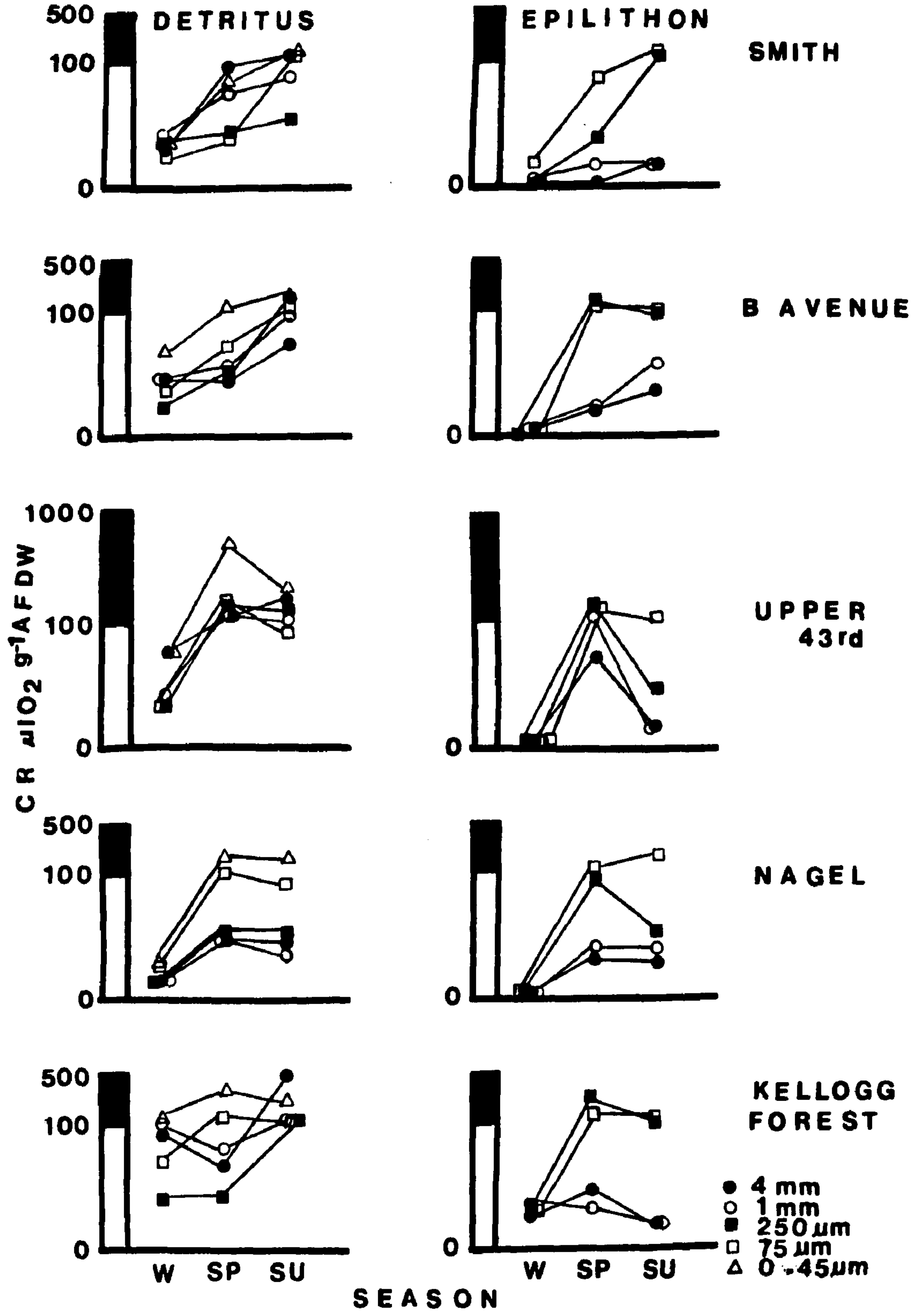


Figure 28. Estimates of CR from particle-sized detritus and epilithon communities from selected riffle sites of Augusta Creek, Kalamazoo County, Michigan (1974-1975).

based on equal colonization of surfaces by a similar flora (i.e. bacteria). In heterogeneous layered substrates differences would be expected in types of colonizers (i.e. autotrophic-heterotrophic components) and particle location (i.e. light availability).

Epilithon CR was also lowest during spring periods; increased during early summer; and remained stable at Smith and B Avenue Sites during the summer, but decreased at the Upper 43rd, Nagel and Kellogg Forest (Figure 28). The decrease at the autotrophic sites resulted during the period of algal senescence; detrital CR increased at the same time indicative of algal inputs to the detrital pool (Edberg and Hofsten 1973).

Rates of epilithon CR ranged from nondetectable for 250 μm sands at Smith, Nagel, and Upper 43rd Sites in early spring to 214.4 $\mu l O_2\ g^{-1} h^{-1}$ for 75 μm sands in June at the Kellogg Forest (Appendix H). Averaged by site, the highest CR was at the Kellogg Forest and Upper 43rd Sites with B Avenue and Nagel Sites approximately equal and Smith lowest (Table 21). The similarity of B Avenue and Nagel epilithon CR would indicate similar levels of colonization, but the percent composition of autotrophs must have varied significantly based on the NCP values (Tables 9, 21). Ranked by increasing activity, the epilithon CR patterns followed the inverse relationship with particle-size proposed for detritus by Fenchel (1970) and Hargrave (1972). Comparing particle-sizes, a similar trend existed; averages for the 75 μm sands were the most active while the 1 mm were lowest at all sites (Table 21). Overall on a weight basis, detritus had higher CR and lower NCP than epilithon.

Particle-sized estimates of community metabolism Areal basis)

On an areal basis, as on a weight basis, the autotrophic colonization was in the epilithon community, but on an areal basis, especially for epilithon, general trends were similar to in situ. This agreement further substantiates the magnitude of epilithon biomass in riffle sections. Average detrital NCP m^{-2}, as on a weight basis, was generally negative with the highest and only positive value at Upper 43rd for 0.45 μm detritus (Table 23). The lowest average values were also for this segment at B Avenue and Smith Sites (Table 23). Averaged for particle-size, the lowest values of NCP were for the UPOM and highest for the CPOM fractions, which differed from a weight basis where UPOM had highest average values (Tables 21, 23). When particles were ranked by site for NCP (Table 24) the averages had a similar pattern to a weight basis, but generally there was direct relationship between rate and particle size not evident on a weight basis (Tables 22, 24). Areal ranked sites were identical to biomass (AFDW) (Tables 22, 24).

The highest average NCP rates were from the epilithon of Upper 43rd 4 mm inorganic sediments, while the lowest rates were from 75 μm sands from the Smith site (Table 23). On an average particle-sized basis contributions of the 4 mm stones were highly separated from the other rates of NCP; the 75 μm sands had the lowest activity. On the weight basis the 75 μm fractions had high levels of activity (Tables 21, 23). Ranking sites by NCP m^{-2} (Table 23), Smith was lowest followed by B Avenue, Kellogg Forest, Nagel and Upper 43rd, while on the weight ranking the autotrophic sites shifted to Nagel, Upper 43rd, and Kellogg Forest. This shift illustrates the effects of epilithon

Table 23. Average estimates of community metabolism of various particle-sizes expressed on an areal basis for five riffle sites of Augusta Creek, Kalamazoo County, Michigan.

Site	4mm	1mm	250μm	75μm	0.45μm	Total m^{-2}
$\bar{X}$ NCP DETRITUS	mg $O_2m^{-2}d^{-1}$					
Smith	- 32.0	- 42.3	- 48.2	- 50.1	-328.7	-501.2
B Avenue	- 35.6	-131.5	-143.1	-132.4	-341.3	-784.0
Upper 43rd	- 28.2	- 31.3	- 31.8	- 2.2	+225.7	136.7
Nagel	- 11.9	- 14.5	- 26.6	- 34.1	-111.3	-198.3
Kellogg Forest	- 4.1	- 24.9	- 43.6	- 51.9	-141.3	-265.7
$\bar{X}$	- 22.4	- 48.9	- 58.7	- 54.1	-132.2	
$\bar{X}$ NCP EPILITHON	mg $O_2m^{-2}d^{-1}$					
Smith	- .1	- 96.9	-173.6	- 22.3	------	-292.3
B Avenue	-380.6	-108.3	-138.2	- 15.4	------	-194.9
Upper 43rd	5046.6	137.4	117.7	23.0	------	5324.8
Nagel	2446.9	155.3	344.0	22.0	------	2968.3
Kellogg Forest	1586.0	70.3	87.4	95.6	------	1654.4
$\bar{X}$	1739.7	31.6	46.9	20.6		
$\bar{X}$ CR DETRITUS	mg $O_2m^{-2}d^{-1}$					
Smith	28.3	48.7	45.9	48.2	339.6	510.8
B Avenue	50.6	173.2	189.5	152.5	462.2	1028.0
Upper 43rd	54.7	63.3	73.0	97.7	446.1	748.6
Nagel	22.0	24.9	35.0	44.4	338.2	464.4
Kellogg Forest	14.8	70.4	74.7	99.0	562.3	821.1
$\bar{X}$	34.1	76.1	83.6	88.4	429.6	
$\bar{X}$ CR EPILITHON	mg $O_2m^{-2}d^{-1}$					
Smith	438.5	105.8	155.7	26.1	------	726.2
B Avenue	1339.3	188.2	284.5	29.9	------	1841.8
Upper 43rd	1382.4	70.0	59.0	12.4	------	1523.8
Nagel	2070.6	200.3	169.0	26.1	------	2466.0
Kellogg Forest	1714.9	117.3	101.1	83.0	------	2016.4
$\bar{X}$	1389.1	136.3	153.9	35.5		

Table 24. Ranked particle-size contributions on an areal basis to estimates of community metabolism from five riffle communities of Augusta Creek, Kalamazoo County, Michigan.

	Particle size rank - Highest to lowest					
Site	Rank	1	2	3	4	5
$\bar{X}$ NCP DETRITUS						
Smith		4mm	1mm	250μm	75μm	0.45μm
B Avenue		4mm	1mm	75μm	250μm	0.45μm
Upper 43rd		0.45μm	75μm	4mm	1mm	250μm
Nagel		4mm	1mm	250μm	75μm	0.45μm
Kellogg Forest		4mm	1mm	250μm	75μm	0.45μm
Sites Average		0.45μm	1mm	250μm	4mm	75μm
$\bar{X}$ NCP EPILITHON						
Smith		4mm	75μm	1mm	250μm	------
B Avenue		75μm	1mm	250μm	4mm	------
Upper 43rd		4mm	1mm	250μm	75μm	------
Nagel		4mm	250μm	1mm	75μm	------
Kellogg Forest		4mm	75μm	250μm	1mm	------
Sites Average		4mm	250μm	1mm	75μm	
$\bar{X}$ CR DETRITUS						
Smith		0.45μm	1mm	75μm	250μm	4mm
B Avenue		0.45μm	250μm	1mm	75μm	4mm
Upper 43rd		0.45μm	75μm	250μm	1mm	4mm
Nagel		0.45μm	75μm	250μm	1mm	4mm
Kellogg Forest		0.45μm	75μm	250μm	1mm	4mm
Sites Average		0.45μm	75μm	250μm	1mm	4mm
$\bar{X}$ CR EPILITHON						
Smith		4mm	250μm	1mm	75μm	------
B Avenue		4mm	250μm	1mm	75μm	------
Upper 43rd		4mm	1mm	250μm	75μm	------
Nagel		4mm	1mm	250μm	75μm	------
Kellogg Forest		4mm	1mm	250μm	75μm	------
Sites Average		4mm	250μm	1mm	75μm	------

development and detrital content of the sediments. In situ estimates of average NCP ranked more closely with epilithon than detrital values (Tables 9, 21, 23).

Even though CR estimates g^{-1} AFDW detritus were consistently higher than for epilithon (Table 21), when expressed on an areal format the reverse was true and the impact of the epilithic community established (Table 23). UPOM for which there is no inorganic counterpart had higher CR than all of the inorganic fractions except 4 mm stones, noting the importance of the two extremes in particle-size and sediment types in the autotrophic-heterotrophic balance of riffle sections. Detrital CR was highest (average m^{-2}) at the Kellogg Forest for UPOM and lowest at Nagel Site for 4 mm pieces. Averaged by particle-size the highest and lowest components remained the same and were similar to a weight basis. Areal particle-size ranking indicated the generally accepted trend of CR inversely related to particle-size (Fenchel 1970, Hargrave 1972, Naiman and Sedell 1979b). On a weight basis this pattern was characteristic only of the Nagel site (Table 22).

Epilithon CR was higher than detrital on an area basis, and even the lowest Smith epilithon had higher CR m^{-2} than all except B Avenue and Kellogg Forest detrital particles (Table 23). On an average the 4 mm particles dominated CR at all of the sites and 75 µm sands contributed the least to epilithon CR. These average trends were characteristic of all sites with a direct relationship noted between particle-size and CR (Table 23). On the weight basis (Tables 21, 23) the reverse was true. This reversal indicated a more active, but lesser developed microflora on the sands.

When extrapolated to an areal basis, negative values of NCP, GCP, and NDM were consistently measured on detritus at the Smith Site with the 0.45 μm fraction predictably lowest; the others were significantly different and closely grouped (Figure 29). The 4 mm detritus, indicating some algal colonization, had the highest rates of NCP and the lowest rates of CR. CR was highest in the 0.45 μm fractions and increased with seasonal temperatures as did _in situ_ CR (Figure 16). The consistently low NDM and P/R ratios of both detrital and epilithon fractions indicated heterotrophic colnization of all substrates and the heterotrophic character of this first order site (Figures 17, 18, 29, 30).

Within the epilithic community, as well, little autotrophic potential existed (Figure 30). The only positive value for NCP was on 4 mm substrates during the February diatom bloom, which indicated a more diverse flora was present. The 75 μm sands had the least negative and most consistent levels of NCP, but as evidenced by GCP values, only in June rose above baseline in primary productivity. The 1 mm and 75 μm inorganic sediments had maxima in GCP just after the major diatom bloom which may be the result of diatom community changes within the sediments from the _Meridion_ - _Diatoma_ bloom forms to smaller motile migratory forms which may colonize smaller sediments. However, only taxonomic analyses could substantiate this hypothesis. The comparison of particle-size specific epilithon NCP trends to _in situ_ measurements indicated similar patterns as did the detrital component, which reinforced the dominance of heterotrophic processes with the riffle community.

B Avenue detritus, like Smith, had negative values of NCP, GCP,

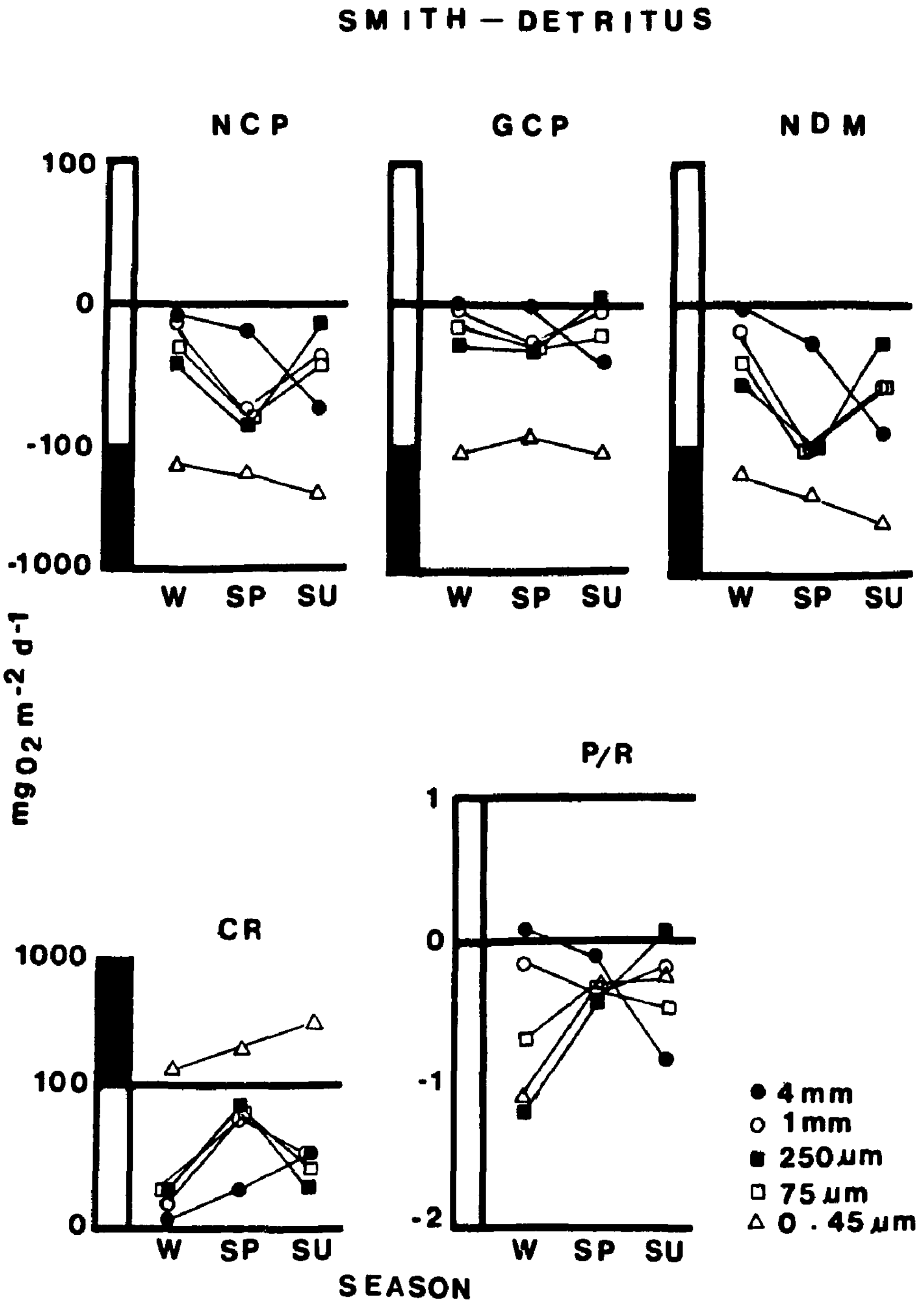


Figure 29. Estimates of particle-sized community metabolism of the detrital component of Smith riffle sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

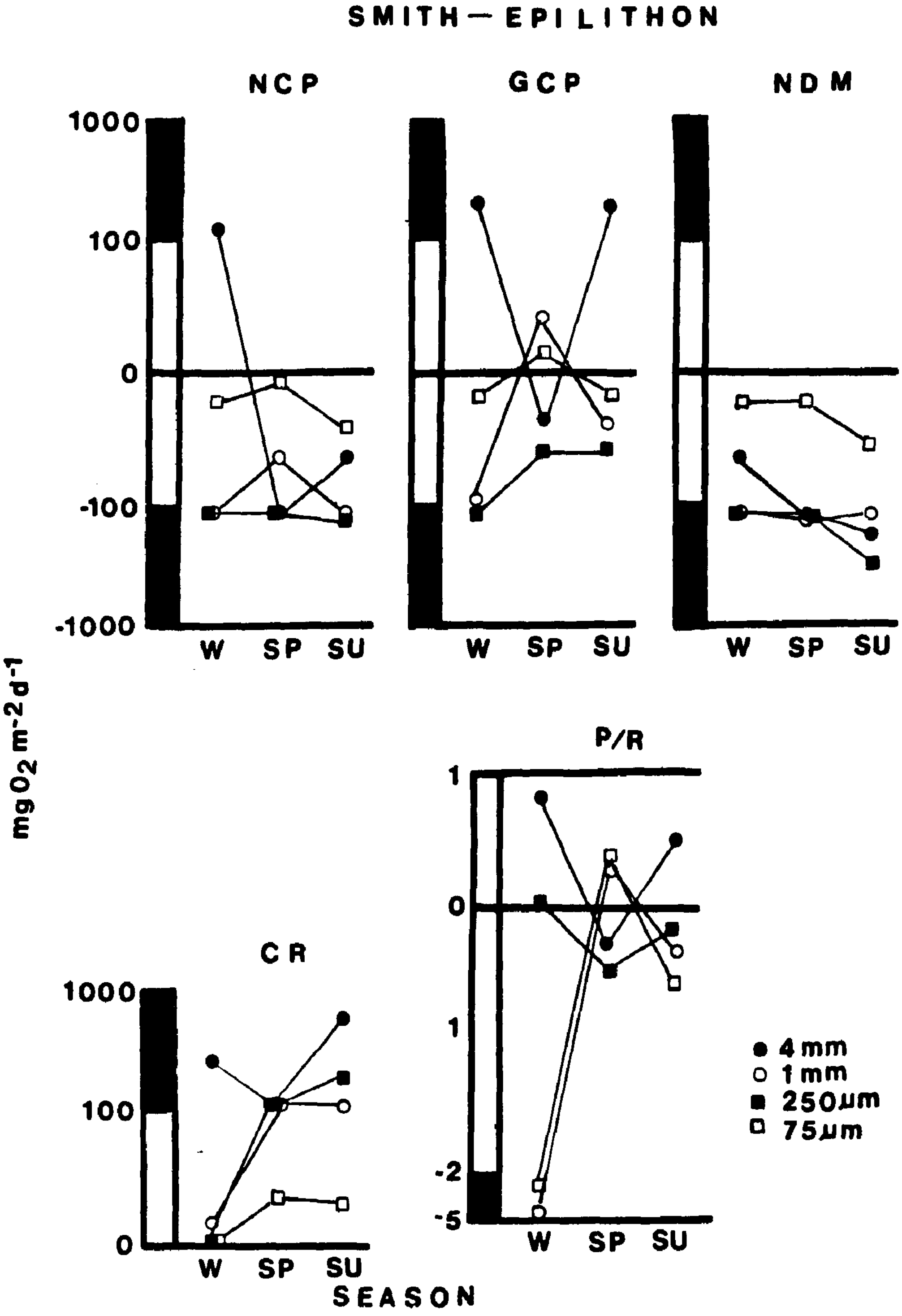


Figure 30. Estimates of particle-sized community metabolism of the epilithon of Smith riffle sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

and NDM which mimiced in situ trends (Figues 31, 14-18). On a comparative scale the UPOM particles were lowest and 4 mm detrital particles highest in autotrophic potential. The similarity in rates of NCP and CR of the other particles indicated that after breakdown to 1 mm and finer, detrital particles had a consistent heterotrophic (probably largely bacterial) flora; the UPOM, where increased surface area to particle size was greatest, had maximized colonization and increased rates of CR. P/R ratios, indicating the heterotrophic nature of detritus in the B Avenue riffle sections, were similar in magnitude to those of Smith detritus and all were significantly less than one (Figure 31).

The primary productivity capacity of the inorganic substrates at the B Avenue riffles also depicted a dependence on allochthonous substrates (Figure 32). NDM was below zero for all particles over the sampling period. NCP was positive only for 4 mm and 250 μm particles in the spring during the diatom bloom; levels of NCP were highest for most particles during that period. As in situ, the P/R ratios were consistently less than one with the highest levels in spring; patterns of epilithon CR were also similar to in situ (Figures 32, 14-18). When comparing detrital and epilithon autochthonous contributions to riffle community metabolism at this site it was obvious that the little algal colonization which occurred did so in the epilithon community.

As on a weight basis, the small autotrophic potential demonstrated at the Upper 43rd Site in the detrital community, was due to the 0.45 μm particulate fraction in June (Figure 33). This June maximum was evident in in situ measurements of NCP, GCP, and NDM as

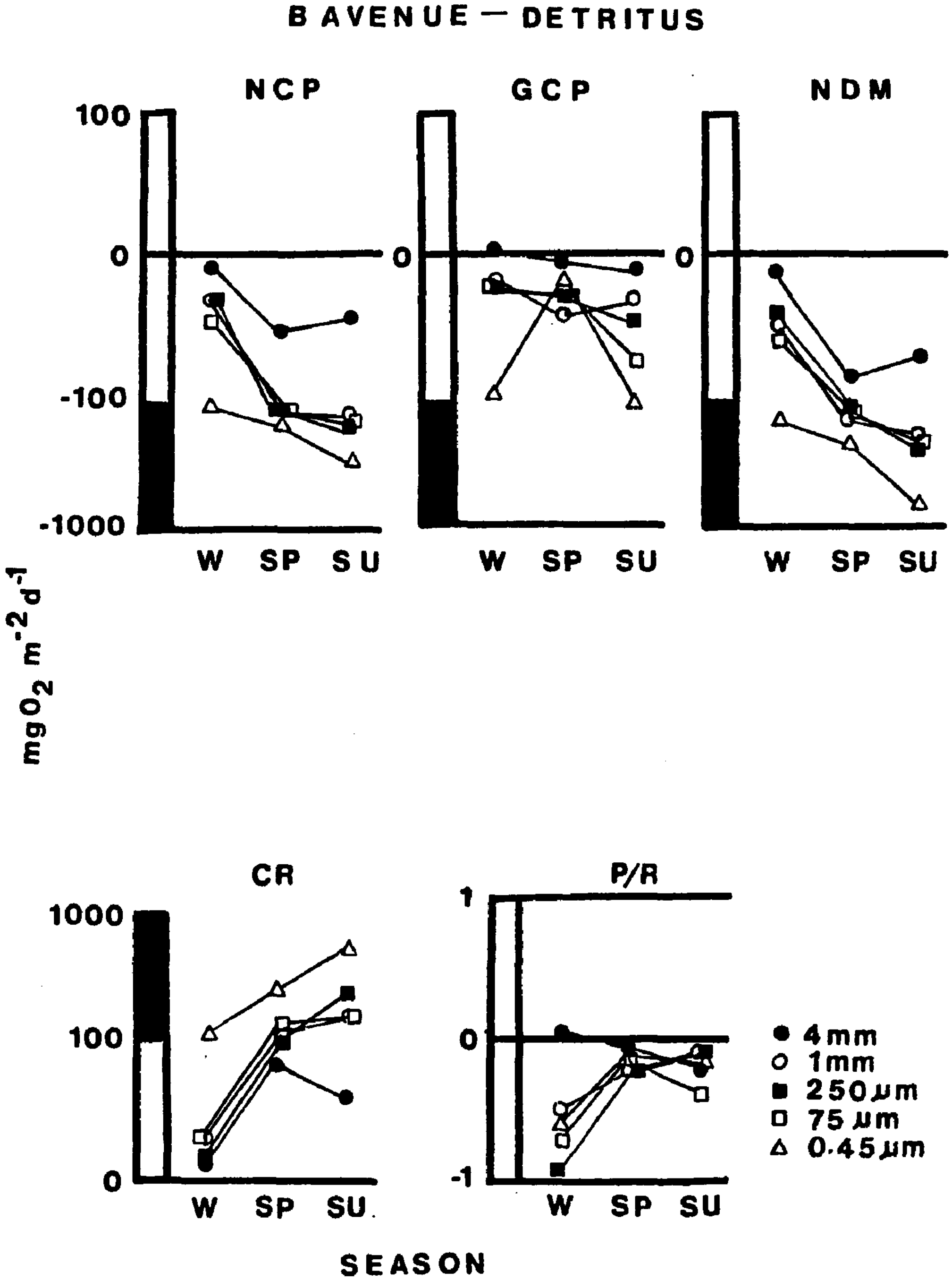


Figure 31. Estimates of particle-sized community metabolism of the detrital component of B Avenue sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

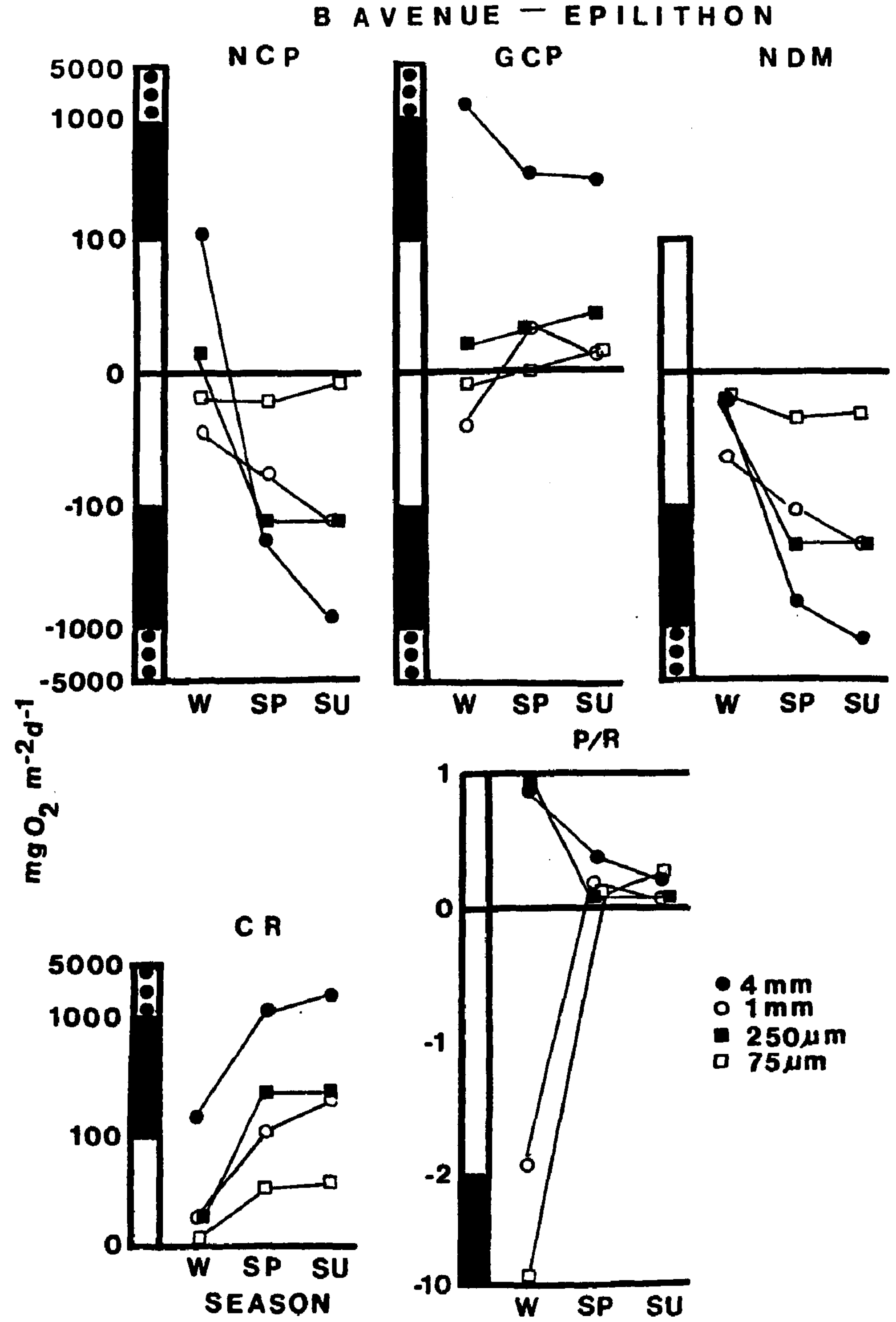


Figure 32. Estimates of particle-sized community metabolism of the epilithon of B Avenue riffle sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

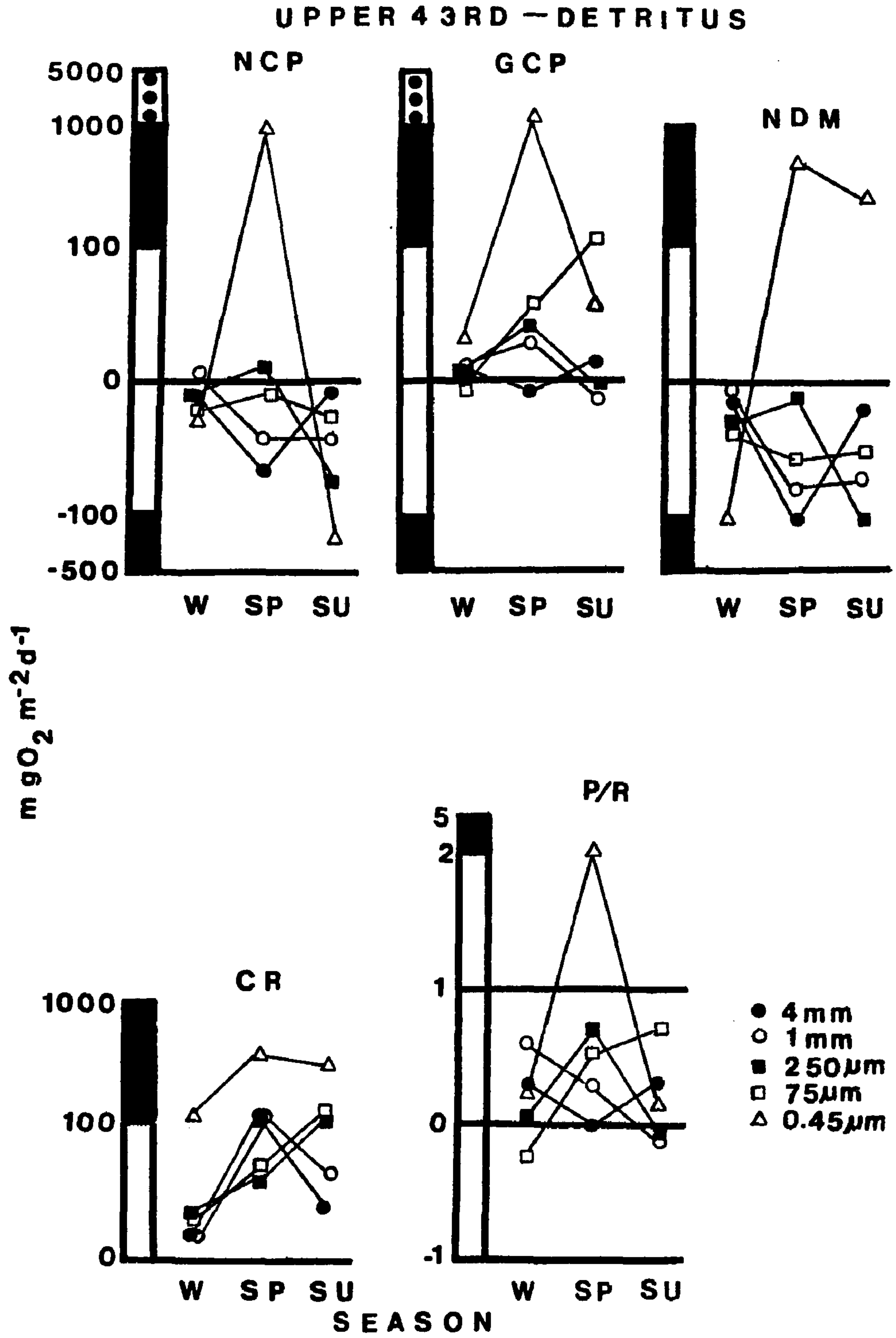


Figure 33. Estimates of particle-sized community metabolism of the detrital component of Upper 43rd riffle sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

well (Figures 33, 14, 15, 18). Although NCP was positive only during June, GCP in the UPOM fraction was positive from February to August. During February, diatom colonization was evident on all available surfaces and could well have been a part of the FPOM pool. The June increases in the UPOM fraction as well as the 75 μm particles were related to periods of algal input. Length measurement of two common diatoms of the spring bloom: Diatoma vulgare Bory (30 to 60 μm length) and Meridon circulare (12 to 80 μm length) (Hustedt 1930) support this hypothesis. NDM in the 75 μm fraction indicated carbon was produced in excess during June and August, while the other particle sizes were generally below zero in NCP and NDM (Figure 33). GCP was positive for most particles; the 75 μm and 0.45 μm particles had the highest values. CR was highest for the UPOM with other sizes lower and similar (Figure 33). P/R ratios were generally below one, but much higher than the Smith and B Avenue values. These data suggest algal colonization and autochthonous contributions to the energy base of the Upper 43rd riffle by the detrital community.

Based on levels of particle-sized epilithon primary productivity, the Upper 43rd epilithon community had a definite algal component (Figure 34). The only similarity with detrital contributions was levels of CR (Figure 33); even maxima of productivity occurred at different times with epilithon proceeding detrital, which added support to the algal input hypothesis. NDM and P/R ratios were above one indicating an autotroph dominated system in most cases. The 4 mm inorganic particles had the greatest contributions to the autochthonous organic pool of the riffle section as indicated by values of NCP, GCP, NDM, and P/R (Figure 34). High rates of CR for the larger inorganic

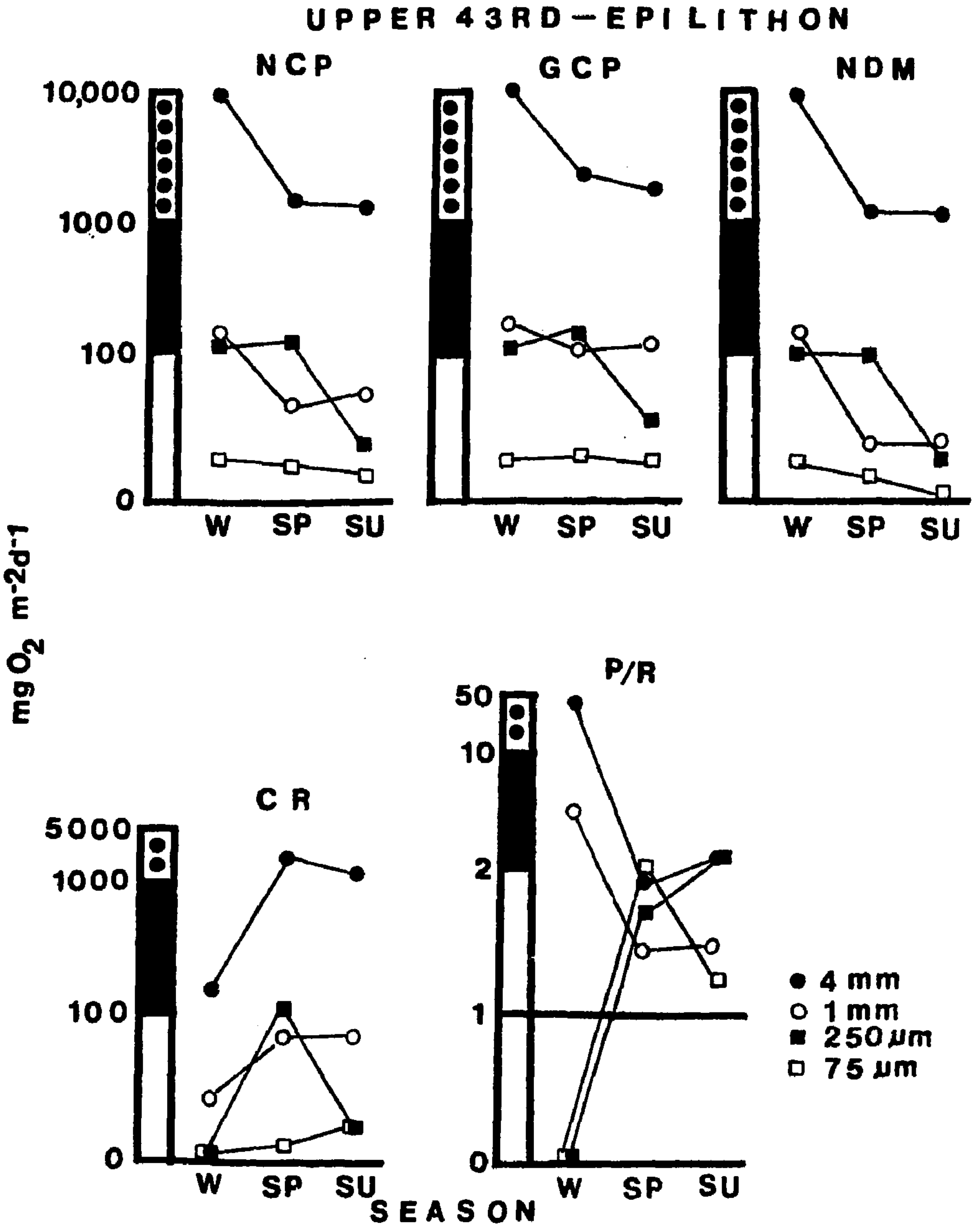


Figure 34. Estimates of particle-sized community metabolism of the epilithon of Upper 43rd riffle sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

substrates indicated higher colonization both heterotroph and autotroph (Figure 34). The smallest sands had the least impact from all standpoints. While detrital patterns in NCP (Figure 33) did not follow in situ trends, the epilithic contributions did, which indicated a dependence on epilithon development for increased NCP.

At the Nagel Site patterns of detrital community metabolism were similar to those of Upper 43rd (Figures 33, 35). NCP values were negative and very similar for all segments, GCP was positive during the February diatom bloom for 4 and 1 mm pieces and 0.45 μm detritus in June and August (Figure 35). The summer increases were related to algal sloughing into the detrital pool. CR was also highest for this site in the UPOM with other sizes lower and similar in value. P/R ratios were all less than one and intermediate between the extreme lows of B Avenue and Smith Sites and the higher Upper 43rd values. The only trend similar to in situ measurements was for CR (Figure 35).

Particle-sized estimates of community metabolism at the Nagel site further expanded the importance of the larger stones as substrates for colonization (Figure 36). The patterns and magnitudes of parameters were similar to those of the Upper 43rd epilithon, and reflected in situ trends. This further substantiates the productivity potential of inorganic sediments within autotrophic riffles (Figures 34, 36).

Consistently below zero levels for NCP, NDM and P/R characterized the heterotrophic nature of the Kellogg Forest detritus. The 4 mm fragments had the highest percentage algae/surface area as it yielded the highest estimates of NCP and NDM with the lowest rates of CR (Figures 37). The highest CR and corresponding lowest NCP and NDM

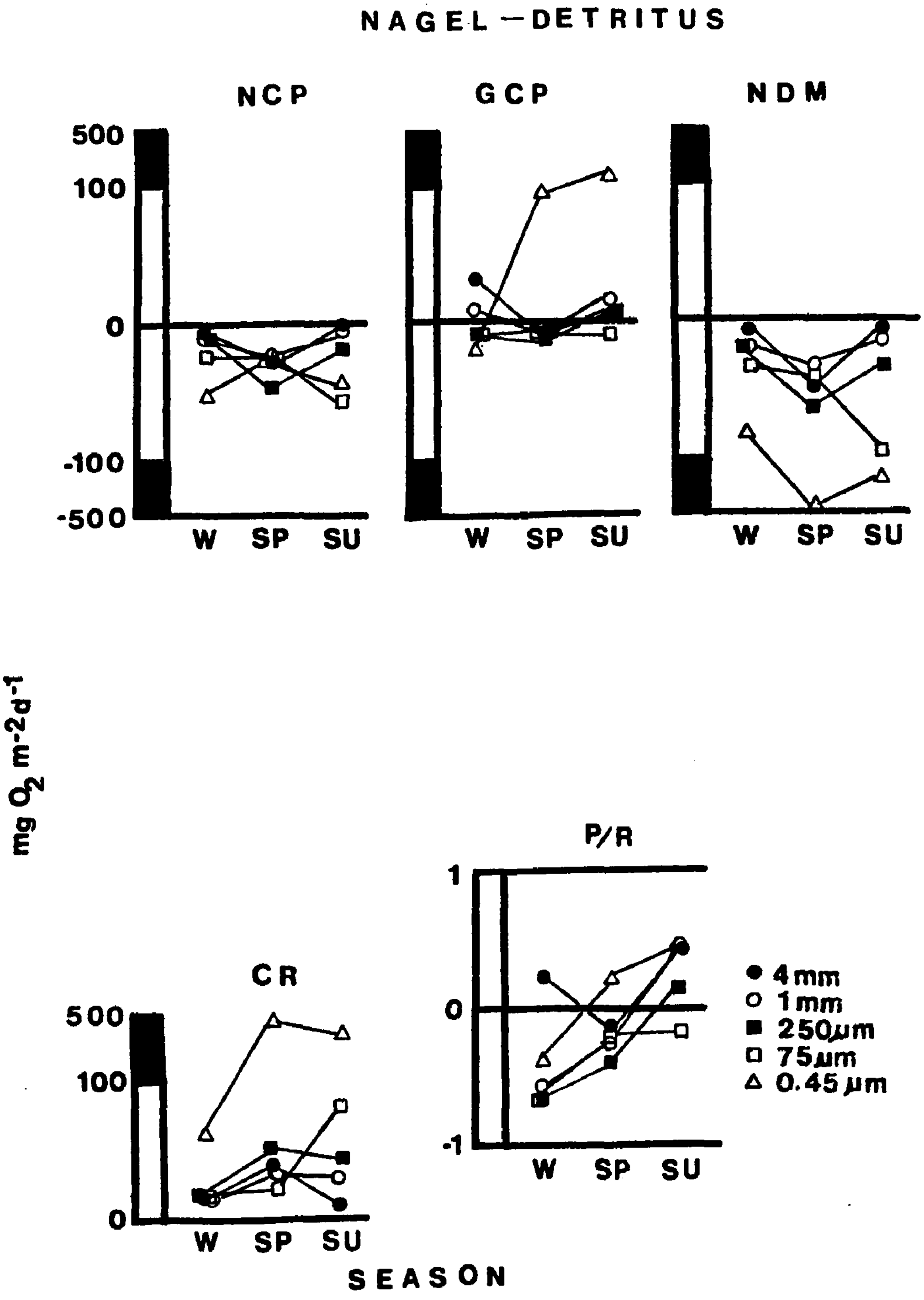


Figure 35. Estimates of particle-sized community metabolism of the detrital component of Nagel riffle sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

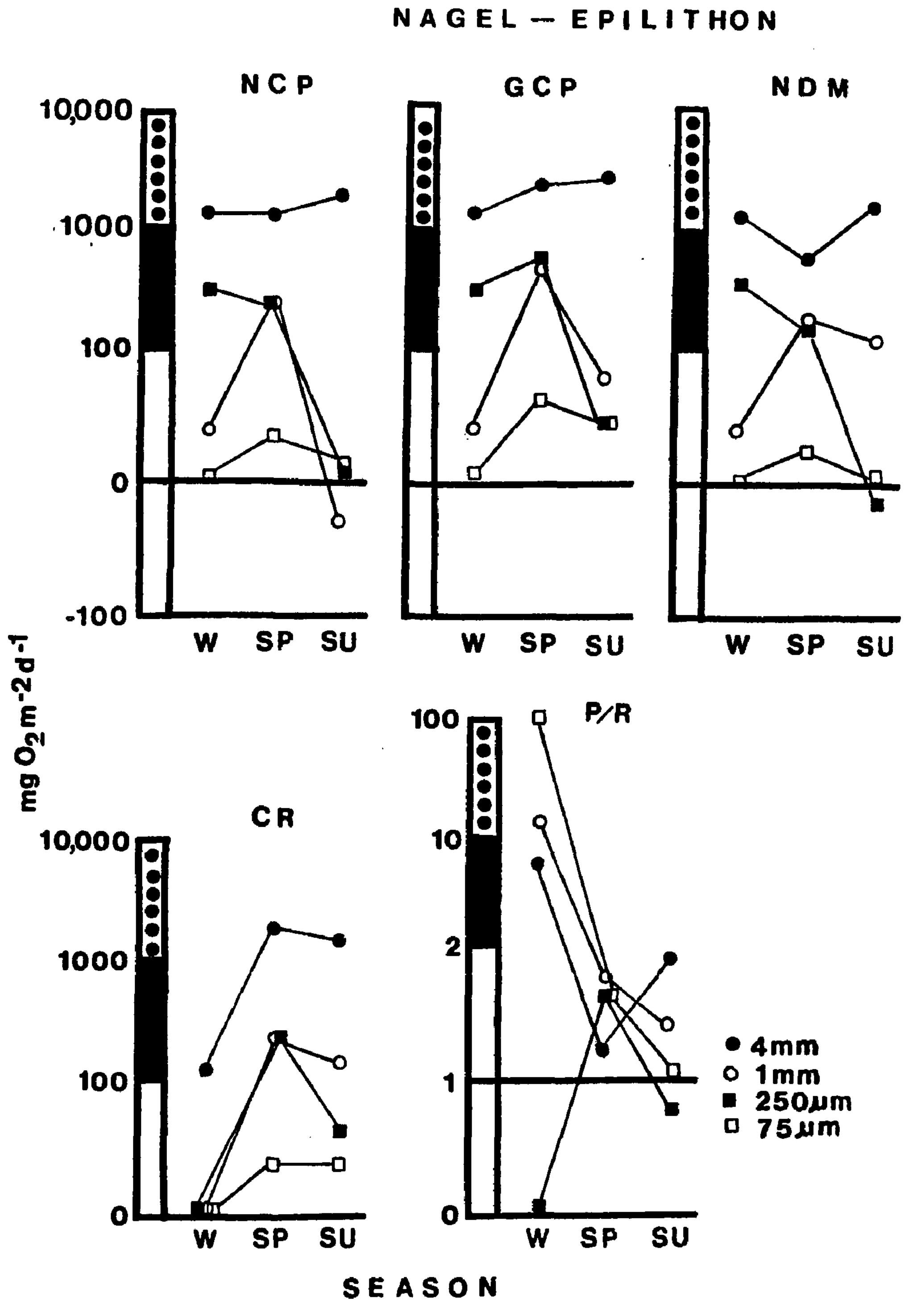


Figure 36. Estimates of particle-sized community metabolism of the epilithon of Nagel riffle sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

were from the UPOM particles. GCP was positive for the UPOM segment which indicated potential algal inputs into this pool, yet NDM remained below zero for all segments. P/R ratios were similar to Nagel (below one) and intermediary to the extremes. The UPOM ratios were again the highest and most consistent (Figure 37). CR patterns were similar for all groups of detritus except 75 μm, which may have been increased by algal inputs, as at Upper 43rd. Illustrating the dependence of NDM on CR and in turn amounts of detritus in the sediments, estimates of detrital NDM and *in situ* NDM indicated similar patterns. General correspondence with *in situ* trends was seen only for the 0.45 μm fraction, which notes the importance of this fraction in the autotrophic-heterotrophic community balance (Figures 37, 14-18).

Autotrophic productivity of the epilithon at the Kellogg Forest was lowest during the early spring, increased in summer and decreased in late August (Figure 38). NCP and GCP values were positive for most particles over the experimental period and were similar to *in situ* (Figures 14, 15). CR rates followed the same pattern as NCP, GCP and *in situ* except 4 mm epilithon which remained high and stable (Figures 16, 38). NDM was characteristically above zero and was similar to *in situ* patterns (Figures 18, 38). In all cases 4 mm particles had the highest impact on overall NCP, GCP, CR, and NDM others were similar in levels of activity. The P/R ratios of 1 mm sands were consistently above one, while each of the others at some period fell below the compensation point (Figure 38). The only inorganic particles which followed *in situ* P/R trends were the 4 mm stones (Figures 17, 38). This site indicated a photosynthetically active community with all

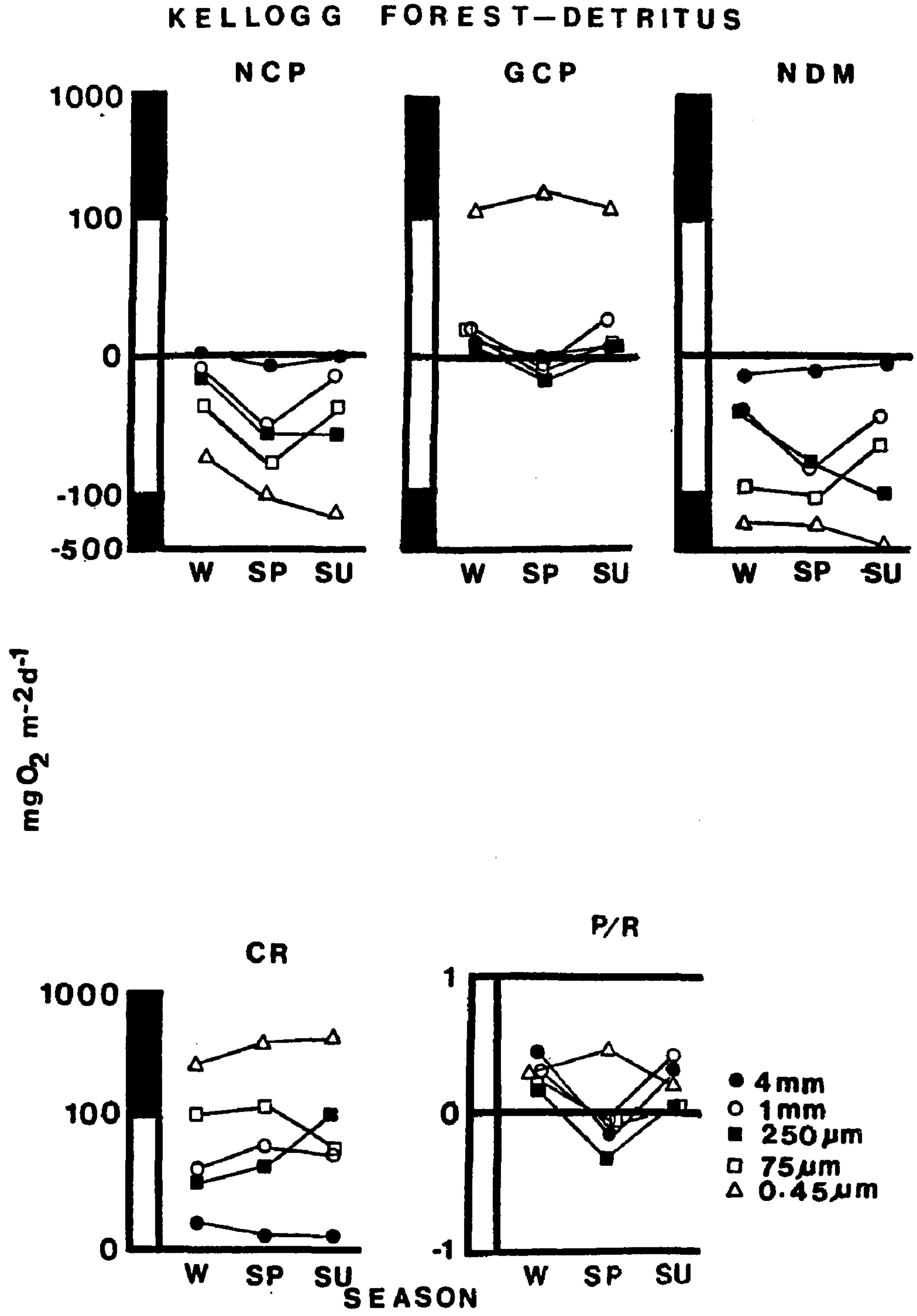


Figure 37. Estimates of particle-sized community metabolism of the detrital component of Kellogg Forest riffle sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

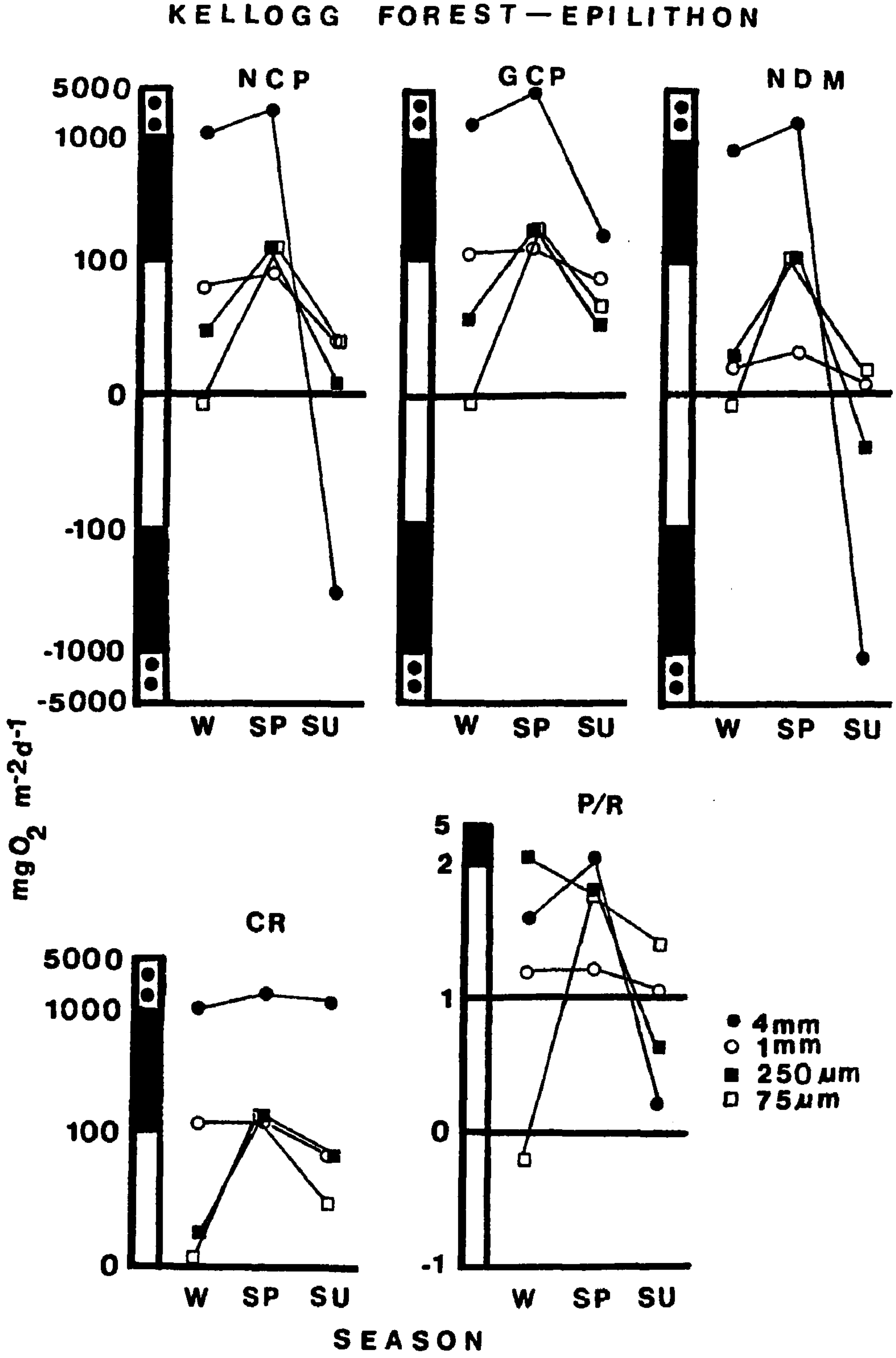


Figure 38. Estimates of particle-sized community metabolism of the epilithon of Kellogg Forest riffle sediments, Augusta Creek, Kalamazoo County, Michigan (1974-1975).

inorganic sediments contributing to the autotrophic potential of the riffle reach. However, the majority of colonization occurred on 4 mm and larger particles.

SYNTHESIS

Babbling brooks won't tell...
Sunlight dappling jubilantly won't tell...
Neither will the stately adjacent tree or jewelweed glistening
in a patch of sunlight bankside...
Of the complexity within. February 1982

Using a chamber method, *in situ* measurements of community metabolism, light, temperature, and substrate composition were monitored over a two year period in five riffle sections of Augusta Creek, Michigan. These included the first order shaded Smith and B Avenue Sites, meadow second order Upper 43rd Site, cleared third order Nagel Site, and the shaded third order section in the Kellogg Forest. During 1973-1974 daily estimates were made each month at B Avenue and Nagel Sites and daily seasonal estimates were made at the five sites during 1974-1975.

Physical and biological differences between sites were illustrated and reinforced the complexity of patterns of stream metabolism and productivity potential of woodland stream riffle sections.

Temperature

Typical temperate region seasonal patterns of temperature occurred at each site with maximum temperatures during the summer and minima during the winter. Maxima at the sites ranged from 19.9 C at

Smith and B Avenue Sites to 24.8 at Upper 43rd Site. Average daily temperatures ranged from 0.4 C at Upper 43rd in winter to 22.6 C at Nagel in August. First order sites were lowest, open sites highest, and shaded Kellogg Forest intermediary. Average daily temperatures plateaued at maximum temperatures in June and remained high until September at both shaded and open sections.

Greatest daily temperature fluctuations ranged from 5.8 to 10.5 C with the highest fluctuations occurring at first order sites during spring and fall. Indicating the importance of canopy in maintaining cooler conditions, the largest annual averages were for the open sites.

Light

Average daily light measured at the riffle sections was highest (90,213 lux) at Upper 43rd in May and lowest (2,391 lux) at B Avenue in January, while averages over the study period ranged from 12,054 lux at Smith to 43,622 lux at Upper 43rd. First order sites were lowest, open sites highest and Kellogg Forest intermediary.

Smith and B Avenue sites received only 45% of the illumination of the shaded third order Kellogg Forest and only approximately 30% of the open sites. Open sites received approximately 140% of the shaded third order sites and Kellogg Forest approximately 66% of the light at open sites. Open sites displayed light patterns typical of temperate regions with spring-summer maxima and winter minima. June through September (leaf-out) light reductions were evident at Smith and B Avenue sites as were increases in light after canopy abscission. Even though complex dappled light patterns were evident at the Kellogg

Forest site, significant light inputs were evident. On a comparative scale lower light values were evident due to shading at these three sites even during winter.

Ranking by average light input Smith was lowest followed by B Avenue, Kellogg Forest, Nagel, and Upper 43rd. Thus, light trends indicated the diversity of light patterns natural and man made along a continuum.

Community Metabolism

GCP values, ranging from 0.09 to 5.35 g O_2 $m^{-2}d^{-1}$ at Smith Site in winter and Nagel Site in August, respectively, varied seasonally and between sites over the annual period. Highest values were during the spring at naturally shaded sites and summer at open sites. On an average the lowest levels were at Smith followed by B Avenue, which had a wider channel and approximately two times the GCP of Smith; Kellogg Forest; Upper 43rd; and Nagel. Levels of GCP from the first order sites were lower than reported literature values. Open sites had approximately 13% higher GCP than the first order reaches. Clearing shifted the autotrophic capacity to values typical or larger rivers.

NCP values followed the seasonal trends displayed by GCP and ranged from -0.25 g O_2 $m^{-2}d^{-1}$ at Smith during the fall to 4.03 g O_2 $m^{-2}d^{-1}$ at Nagel Site in August. The low value, during the fall, may have been the effect of leaf inputs into the shaded Smith reach and the maximum value correlated with luxuriant algal development at Nagel Site. Indicating heterotrophic conditions and a dependence on allochthonous or stored organic matter, negative NCP values were consistent at the first order sites. Open sites and the Kellogg Forest Site indicated positive NCP values, thus, autotrophic bases. Sites ranked by average NCP were identical to GCP trends with the effects of clearing obvious from comparison of Kellogg Forest and Nagel Sites. Light saturated NCP occurred within the range of 15,000 to 24,000 lux at sites of Augusta Creek and combined sites indicated a saturation level of approximately 20,000 lux. Smith exhibited no saturation plateau, but light values rarely exceeded 20,000 lux at this site. Temperature did not affect light saturation thresholds. No photoinhibition was indicated at either autotrophic or heterotrophic sites.

Rates of CR varied significantly between shaded and open sites. The range of values was 0.24 g O_2 $m^{-2}d^{-1}$ during January at B Avenue to 3.67 g O_2 $m^{-2}d^{-1}$ during July at Nagel Site. On an average basis B Avenue and Smith were similar and low, Kellogg Forest was intermediate, and Nagel and Upper 43rd were similar and higher in values. Kellogg Forest rates approximated rates of the heterotrophic sites with the only significant deviation occurring during periods of leaf-out when CR levels increased at Kellogg Forest corresponding with increased epilithon development. Seasonal patterns were similar at most sites with lowest rates during the winter and highest values during spring or summer. An inverse relationship was noted between CR and NCP at heterotrophic sites. CR as a percent of GCP varied from 445% at Smith to 55% at Kellogg Forest. Autotrophic sites averaged 65% while heterotrophic sites averaged 322%, which indicated a considerable deficit of organic carbon from autochthonous organisms at B Avenue and Smith Sites. Effects of clearing at Nagel compared to the shaded Kellogg Forest indicated increased CR with greater epilithon development at the Nagel Site.

P/R ratios at the five sites indicated consistent consuming modes at B Avenue and Smith and producing modes at the open and Kellogg Forest Sites over the year. Upper 43rd, closest to P/R = 1, indicated little excess autochthonous production for export or storage. Lowest P/R ratios were obtained on a snowy overcast day at B Avenue (-0.017) and highest (2.5) at the Nagel Site in August. Average P/R ratios ranked sites in increasing order: Smith, B Avenue, Upper 43rd, Nagel, Kellogg Forest. A trend of increasing P/R with increased stream order was noted. The high levels at Kellogg Forest were attributed to lesser development of epilithon with increased light availability maximizing efficiency and, thus, indicated the autotrophic potential of shaded third order reaches. Highest ratios corresponded with trends of GCP and NCP with spring peaks at all sites and maximum in summer at the cleared Nagel site. Low values were during the winter at all sites. The low ratios obtained at Smith and B Avenue were similar to those reported from turbid or polluted systems and the open sites approximated values of larger rivers. Average P/R ratios from monthly estimates at B Avenue and Nagel Sites were not significantly different from averages obtained on a seasonal basis, which indicated seasonal monitoring was sufficient to characterize the autotrophic-heterotrophic capacity of a riffle.

NDM values were similar to NCP and P/R trends, but were lower in magnitude. Values ranged from -0.72 g O_2 $m^{-2}d^{-1}$ in fall at Smith to 2.68 g O_2 $m^{-2}d^{-1}$ in August for Nagel. Lowest NDM values were in the winter, and at B Avenue and Smith consistent negative values indicated dependence on allochthonous POM since no pool of autochthonous carbon was present. Lowest values, during fall at Smith, indicated the effects of increased CR concominant with CPOM inputs. Open sites and the Kellogg Forest Site were autotrophic in nature as indicated by positive NDM values with Nagel and Kellogg Forest capable of storage or export of autochthonous carbon and Upper 43rd Site was basically self-supporting with periods of potential dependence on the slight storage capacity or POM or allochthonous carbon corresponding to periods of low NCP and NDM. Average NDM was lowest at Smith followed by B Avenue, Upper 43rd, Kellogg Forest and Nagel, which indicated that even though the highest P/R ratios were at Kellogg Forest, actual carbon production was greatest at Nagel and that the shaded Kellogg Forest produced more excess carbon than the open Upper 43rd Site.

Detrital standing crop analyses indicated stable levels of detritus at each site with all but the extremes (Smith high and Upper 43rd low) similar in amounts. Standing crops ranged from 592 to 145 g m^{-2}. No consistent seasonal trends were found between sites. First order sites had greater variance in standing crop levels while open and Kellogg Forest Sites remained stable. Average detrital standing crops for sites ranked in decreasing order were Smith, Nagel, B Avenue, Kellogg Forest and Upper 43rd. The high levels of detritus at Nagel were attributed to inputs of filamentous algae and aquatic macrophytes as were the high average CPOM/FPOM ratios. This ratio varied from 0.06 during summer at Kellogg Forest to 0.68 at Nagel Site in winter with an inverse relationship between CPOM/FPOM and P/R. On an average basis sites ranked in CPOM/FPOM ratio in increasing order were Kellogg Forest, Smith, Upper 43rd, B Avenue, Nagel.

Patterns of community metabolism expressed on a g^{-1}AFDW detritus basis did not reflect levels of standing crop, as values varied in activity differently from detrital ranking. CR maxima were highest during the fall in contrast to spring and summer on an area basis, which was attributed to a more labile (algal) input to the riffles at that time. First order sites were more stable in rates of community metabolism per gram detritus over the year which indicated a bacterial metabolic base. NDM values, indicating a dynamic equilibrium with each community of either an autotrophic or heterotrophic energy base, were consistent at each site. Since standing crop levels were not significantly different at most sites, little change in community metabolism trends were expected expressed on a weight basis.

The concept of use of epilithon development (AFDW) as a mechanism to monitor autotrophic-heterotrophic capacities of riffle reaches was introduced. Values, obtained by ashing inorganic substrates including detrital and algal biomass, ranged from 1480 g m^{-2} at Smith during spring to 5030 g m^{-2} at Nagel during the same period. Obvious visual differences as well as biomass values varied with site and followed patterns of NCP and GCP in the riffles. Sites ranked Smith, B Avenue, Kellogg Forest, Nagel and Upper 43rd in average epilithon development. Seasonal variation was greatest at the open sites (C.V.%), while first order heterotrophic sites remained low and stable indicative of a bacterial base. Kellogg Forest was also stable, but had higher levels of epilithon development than the first order riffles. Even at Smith Site epilithon was a significant component of the total organic standing crop. Based on the low rates of NCP and GCP at this site it was detrital based epilithon, while open and shaded third order sites had algal based epilithon. Peaks of epilithon occurred in fall at Smith during CPOM inputs and at open sites during spring and fall, which correlated with the diatom blooms. Major changes occurred on the larger substrates. Detritus averaged 12% of the TPOM; the range was 18% at Smith Site to 7.5% at Upper 43rd Site. Differences existed between autotrophic and heterotrophic sites. Use of the E/D ratio for characterization of riffle reaches was proposed. Average E/D ranged from 4.5 at Smith to 14.8 at Upper 43rd with increased importance of the epilithon (Algal and detrital) at the open sites. E/D had a direct relationship with NCP, GCP, and P/R for sites of Augusta Creek. However, higher values of E/D were obtained on an extremely heterotrophic riffle reach of a branch of the Yellowstone River, Montana, which indicates E/D indicative of the epilithon to non-attached detritus contribution to riffle energy bases, but NCP, P/R, and NDM estimates indicate the detrital-algal (autotrophic-heterotrophic) contributions of the components. E/D ratios used with P/R and NDM were of value in characterization of riffle sections.

Regression Analyses

Regression analyses involving the independent variables stream order light, temperature, detritus AFDW, epilithon AFDW, and total particulate organic matter and the dependent variables NCP, GCP, CR, and NDM indicated stream order to be the most highly correlated parameter with all dependent variables ($R = 0.52$ to 0.74; $F = 37$ to 122). Therefore, the importance of geomorphology was evident from a functional standpoint.

Light was also highly significant ($P < 0.01$) in cases of NCP, GCP, and NDM based on average values (R = 0.52 to 0.57; F = 36 to 46) and on an individual basis (R = 0.6; F = 1090). In multiple regression with temperature R = 0.597 for light while the temperature R value was only 0.005. Compared with other variable independent variables monitored, light was the most important factor influencing NCP, GCP and NDM. On a site basis positive relationships were evident with light, but not as highly correlated. Significance increased with increasing order which indicated the increasing importance of light on open sites.

Temperature had a positive significant relationship with all average parameters with CR highest (R = 0.65; F = 70) and NCP lowest (R = 0.33; F = 12). As CR varied little over the annual period in headwater first order streams, the relationship was less clear which indicated a stable community in dynamic equilibrium. Temperature was most strikingly related to NCP at open sites; on a site basis the most significant relationships were with temperature.

The detrital content of the sediments had little effect on averaged or site basis community metabolism. Average NCP, and NDM were most highly correlated (R = 0.12; F = 1.3 and R = 0.12; F = 1.4), but not highly significant (P = 0.26, 0.24).

Epilithon development was highly significant with all averaged dependent variables with NCP correlating most closely (R = 0.42; F = 17.6). Although on a site basis significance levels decreased, a much stronger relationship existed for epilithon and rates of community metabolism than detritus.

Total AFDW correlations were slightly reduced by addition of detritus in most cases, but were close to the values for epilithon.

Particle Sized Community Metabolism

The impact of various particle sizes (4 mm, 1 mm, 250 μm, 75 μm, 0.45 μm) for detritus and epilithon (Excepting 0.45 μm) was determined. Activity g^{-1}AFDW and areal estimates based on standing crop data were compared to examine the size acitvity and ecological impact respectively. All estimates were higher than *in situ* which indicated the inadequacy of short term estimates at light saturation levels for estimation of community metabolism, the possibility of disturbing particles in separation, or the potential of maximizing surface in Gilson vessels versus the packed condition typical of *in situ* conditions. However, relative comparisons may be made between particle sizes and sites.

Absolute rates of detrital NCP ranged from -318 to 1688 $\mu lO_1\ g^{-2}h^{-1}$ for 0.45 μm detritus at B Avenue and Upper 43rd respectively. At all sites most particle sizes were similar and negative in NCP except the 0.45 μm fraction, which was generally most negative in value. Average rates at Smith and B Avenue were considerably lower than the autotrophic sites and average particle size rates were highest for 0.45 μm followed by 1 mm, 250 μm, 4 mm, and 75 μm.

CR of detritus particles ranged from 15 to 739 $\mu lO_2\ g^{-1}h^{-1}$ for 4 mm particles at Nagel in March and 0.45 μm detritus at Upper 43rd in June. On an average 4 and 1 mm particles had lowest CR and 0.45 μm particles highest CR, but particles were mainly similar except for high rates in the 0.45 μm fraction. On a site basis 0.45 μm was highest at all sites, but no inverse trend was indicated in CR and particle size. Sizes ranked from lowest to highest CR were Upper

43rd, Kellogg Forest, B Avenue, Smith and Nagel. Detritus CR was higher for all fractions than epilithon on a weight basis. Inorganic sediment CR average 70% the rates of detritus with 4 and 1 mm particles about 35% their detrital counterparts and 250 and 75 μm were nearly equal; a similar, probably bacterial dominated flora, developed on both inorganic and organic substrates.

On epilithon, CR ranged from undetectable for 250 μm sizes at Smith, Nagel,and Upper 43rd to 215 μlO_2 $g^{-1}h^{-1}$ for 75 μm sands in June at the Kellogg Forest Site. Rates exhibited an inverse relationship with particle size. Sites ranked Kellogg Forest, Upper 43rd, B Avenue = Nagel, and Smith in increasing levels of CR. Epilithon CR values were similar at B Avenue and Nagel Sites, but a different floral composition was evident based on levels of primary productivity; B Avenue was bacterial dominated and Nagel algal dominated.

Epilithon NCP had a greater range than detritus (-321 to +2174 μlO_2 $g^{-1}h^{-1}$) for 75 μm Smith sands to 4 mm Kellogg Forest gravel. Averages for particle-sizes indicated 1 mm to be lowest in NCP and 4 mm highest. All inorganic sediment sizes were colonized by autotrophs at Upper 43rd and the majority at Nagel and Kellogg Forest on an annual basis. Heterotrophic sites had little algal colonization indicated, but 4 and 1 mm fractions exhibited weak autotrophic potentials. Sites ranked Smith, B Avenue, Nagel, Upper 43rd, and Kellogg Forest in average increasing NCP.

Since particle-size distribution affects total sediment community metabolism, estimates were calculated on an areal basis. Detrital NCP was generally highest on 4 mm particles with a direct inverse relationship evident between NCP and particle size. On an average site basis 0.45 μm detritus was highest in NCP with no trend following for other particle-sizes. CR averages had an inverse relationship between particle size and CR, which was not evident on a weight basis.

Epilithon NCP and CR on an areal basis were dominated by 4 mm stones followed by 250 μm, 1 mm, and 75 μm size. GCP, calculated only on an areal basis, indicated the detrital segement to be in a comsuming mode with positive values only for 4 mm detritus at B Avenue in the fall, 0.45 μm seasonally, and all segements periodically at Upper 43rd, Nagel and Kellogg Forest. NDM remained below zero for all particle sizes except 0.45 μm in spring and summer at the Kellogg Forest, which indicated algal inputs to the FPOM pool. P/R ratios were all below one except for 0.45 μm particles in spring at Upper 43rd.

Epilithon patterns were more complex with GCP from 4 mm, 1 mm, and 75 μm inorganic sediments contributing periodically at Smith; 4 mm annually and all other periodically at B Avenue; 4 and 1 mm and 250 μm sediments generally contributing annually at Upper 43rd; all sizes positive annually at Nagel; and Kellogg Forst had all except 75 μm sizes in a contributing mode annually. NDM was annually below zero for all particles at Smith and B Avenue and above for the majority of particles at the autotrophic sites. P/R ratios were below one for all sizes at heterotrophic sites and above one for most particles at autotrophic sites with exceptions in the smaller particle sizes.

Overall, 0.45 μm detritus had the greatest CR and all sizes illustrated little productive capacity on a weight basis, while inorganic sediments had greatest NCP on larger substrates and CR in the smaller fractions. On an areal basis productivity was highest on larger fractions of both detritus and inorganic sediments; the majority of NCP occurred on the inorganics. CR was highest on smaller detritus and larger inorganics.

Sites

Smith, a first order site, was heterotrophic in nature, detrital based, dependent mainly on epilithic detritus for organic support with little autochthonous production. What little GCP took place did so on the larger substrates. P/R ratios were less than one, NDM below zero and E/D ratios constant and low (3.7 to 4.8), which indicated the impact of allochthonous inputs to the riffle community.

B Avenue, a slightly larger first order reach, was also heterotrophic dependent on allochthonous detritus trapped in the epilithon, but greater autochthonous activity was evident, which was at times contributing to the community support. Based on NDM and P/R ratios not enough NCP occurred for the riffle to be self-supporting. E/D ratios, averaging 7.9, and ranging from 3.5 to 16.5 indicated greater variability and changes in the epilithon flora compared to Smith Site and illustrated the periodic productive potential of the site.

Upper 43rd, an open second order meadow reach, was annually self-supporting, thus, considered an autotrophic site. Indicating the autotrophic dominance in the epilithon community, P/R ratios were near one and NDM was consistently positive. Epilithon development was high at this site as was CR which continually mediated P/R and NDM. E/D ratios were highest at this site averaging 14.8, which emphasized the importance of the epilithic community to riffle sections. Storage was indicated at this site in the FPOM pool as high rates of NCP occurred as well as increased CR during summer and fall. High rates of NCP at Upper 43rd indicated the effects of lack of canopy at a second order site.

The open third order Nagel Site illustrated the effects of clearing on rates of third order riffle NCP as rates approximated those of larger rivers and were significantly higher than the shaded Kellogg Forest Site.

P/R and NDM indicated a producing mode to be characteristic of both sites, but at Nagel higher epilithon development occurred and subsequently increased CR, while autotrophic colonization was greater as indicated by increased rates of NCP. Indicating continued autochthonous support P/R ratios were well above one over annual periods and E/D ratios were similar to Upper 43rd at Nagel ($\bar{x}$ = 12) and intermediary at Kellogg Forest ($\bar{x}$ = 9.5).

The shaded Kellogg Forest third order riffle was also autotrophic in nature, lesser in productivity than the open site, but also lesser in CR and epilithon development. This riffle section was self-supporting on an annual basis as indicated by the P/R ratios greater than one and positive NDM. E/D ratios ranging from 4.6 to 15.8 indicated the diverse base of this riffle.

The autotrophic-heterotrophic balance in riffle sections was dependent on the epilithon component both in development, which was mediated by light availability, and composition which would also be affected by light, and on a species level temperature dictated.

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APPENDIX A

Table A-1. Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
24 October 1974 (light), 25 October 1974 (dark), SMITH SITE, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.018	-.195	-6.059
	Rep 2	-.034	-.360	-11.16
	Rep 3	-.018	-.193	-5.993
	mean	-.023	-.250	-7.736
	se	.005	.055	1.711
	cv (%)	38.300	38.300	38.300
		g O2/m2.hr	**g O2/m2.da**	**g O2/m2.mo**
COMMUNITY RESPIRATION	Rep 1	.031	.751	23.287
	Rep 2	.038	.910	28.198
	Rep 3	.036	.876	27.156
	mean	.035	.846	26.214
	se	.002	.048	1.494
	cv (%)	9.870	9.870	9.870
		g O2/m2.hr	**g O2/m2.da**	**g O2/m2.mo**
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.013	.139	4.304
	Rep 2	.004	.045	1.391
	Rep 3	.018	.197	6.092
	mean	.012	.127	3.929
	se	.004	.044	1.370
	cv (%)	60.400	60.400	60.400

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.612	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.185
	Rep 2	-.865		Rep 2	.049
	Rep 3	-.679		Rep 3	.224
	mean	-.719		mean	.153
	se	.075		se	.053
	cv (%)	18.178		cv (%)	60.063

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
15 January 1975 (light), 16 January 1975 (dark), SMITH SITE, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.007	-.064	-1.988
	Rep 2	-.008	-.073	-2.251
	Rep 3	-.006	-.060	-1.871
	mean	-.007	-.066	-2.037
	se	.000	.004	.112
	cv (%)	9.557	9.557	9.557

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.011	.271	8.407
	Rep 2	.019	.461	14.285
	Rep 3	.020	.473	14.657
	mean	.017	.402	12.450
	se	.003	.065	2.024
	cv (%)	28.160	28.160	28.160

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.004	.042	1.315
	Rep 2	.011	.108	3.362
	Rep 3	.013	.125	3.888
	mean	.010	.092	2.855
	se	.003	.025	.785
	cv (%)	47.601	47.601	47.601

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.229	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.157
	Rep 2	-.352		Rep 2	.235
	Rep 3	-.347		Rep 3	.265
	mean	-.310		mean	.219
	se	.040		se	.032
	cv (%)	22.602		cv (%)	25.656

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
20 May 1975 (light), 21 May 1975 (dark), SMITH SITE, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.007	-.100	-3.109
	Rep 2	-.004	-.062	-1.920
	Rep 3	-.010	-.143	-4.435
	mean	-.007	-.102	-3.155
	se	.002	.023	.726
	cv (%)	39.875	39.875	39.875

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.021	.492	15.252
	Rep 2	.028	.677	20.981
	Rep 3	.009	.211	6.547
	mean	.019	.460	14.260
	se	.006	.135	4.196
	cv (%)	50.966	50.966	50.966

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.014	.202	6.264
	Rep 2	.024	.354	10.974
	Rep 3	-.001	-.013	-.412
	mean	.012	.181	5.609
	se	.007	.107	3.303
	cv (%)	102.00	102.00	102.00

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.290	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.411
	Rep 2	-.323		Rep 2	.523
	Rep 3	-.225		Rep 3	-.063
	mean	-.279		mean	.290
	se	.029		se	.180
	cv (%)	17.930		cv (%)	107.13

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
17 July 1975 (light), 18 July 1975 (dark), SMITH SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.019	-.287	-8.886
	Rep 2	-.012	-.175	-5.415
	Rep 3	-.015	-.225	-6.989
	mean	-.015	-.229	-7.097
	se	.002	.032	1.004
	cv (%)	24.492	24.492	24.492

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.028	.662	20.534
	Rep 2	.016	.379	11.755
	Rep 3	.023	.564	17.484
	mean	.022	.535	16.591
	se	.003	.083	2.573
	cv (%)	26.865	26.865	26.865

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.008	.125	3.888
	Rep 2	.004	.061	1.898
	Rep 3	.008	.125	3.888
	mean	.007	.104	3.224
	se	.001	.021	.663
	cv (%)	35.635	35.636	35.635

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.537	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.189
	Rep 2	-.318		Rep 2	.161
	Rep 3	-.439		Rep 3	.222
	mean	-.431		mean	.191
	se	.063		se	.018
	cv (%)	25.438		cv (%)	15.985

Table A-1. Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
26 January 1973 (light), 25 January 1973 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.002	-.023	-.728
	mean	-.002	-.023	-.728
	se			
	cv (%)			

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.011	.274	8.482
	mean	.011	.274	8.482
	se			
	cv (%)			

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.009	.088	2.729
	mean	.009	.088	2.729
	se			
	cv (%)			

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.186	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.322
	mean	-.186		mean	.322
	se			se	
	cv (%)			cv (%)	

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
07 June 1973 (light), 06 June 1973 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.016	.247	7.423
	Rep 2	.003	.046	1.366
	mean	.010	.146	4.395
	se	.007	.101	3.028
	cv (%)	97.456	97.456	97.456
		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.037	.890	26.712
	Rep 2	.021	.511	15.336
	mean	.029	.701	21.024
	se	.008	.190	5.688
	cv (%)	38.261	38.261	38.261
		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.053	.811	24.318
	Rep 2	.024	.369	11.066
	mean	.039	.590	17.692
	se	.015	.221	6.626
	cv (%)	52.965	52.965	52.965

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.080	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.910
	Rep 2	-.142		Rep 2	.722
	mean	-.111		mean	.816
	se	.031		se	.094
	cv (%)	39.797		cv (%)	16.361

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
05 July 1973 (light), 04 July 1973 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.007	-.106	-3.292
	Rep 2	-.016	-.244	-7.571
	mean	-.012	-.175	-5.432
	se	.005	.069	2.140
	cv (%)	55.711	55.711	55.711
		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.039	.924	28.644
	Rep 2	.021	.492	15.252
	mean	.030	.708	21.948
	se	.009	.216	6.696
	cv (%)	43.145	43.146	43.146
		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.031	.478	14.814
	Rep 2	.004	.067	2.069
	mean	.018	.272	8.441
	se	.014	.206	6.372
	cv (%)	106.76	106.76	106.76

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.446	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.517
	Rep 2	-.425		Rep 2	.136
	mean	-.436		mean	.326
	se	.010		se	.191
	cv (%)	3.376		cv (%)	82.635

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
02 August 1973 (light), 01 August 1973 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.006	.082	2.548
	Rep 2	.006	.082	2.548
	mean	.006	.082	2.548
	se			
	cv (%)			

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.025	.600	18.600
	Rep 2	.037	.893	27.677
	mean	.031	.746	23.138
	se	.006	.146	4.538
	cv (%)	27.739	27.739	27.739

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.031	.443	13.724
	Rep 2	.043	.619	19.177
	mean	.037	.531	16.450
	se	.006	.088	2.727
	cv (%)	23.442	23.442	23.442

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.157	**GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION**	Rep 1	.738
	Rep 2	-.274		Rep 2	.693
	mean	-.216		mean	.715
	se	.058		se	.022
	cv (%)	38.313		cv (%)	4.433

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
29 August 1973 (light), 30 August 1973 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.004	-.053	-1.649
	Rep 2	-.012	-.166	-5.154
	mean	-.008	-.110	-3.401
	se	.004	.057	1.752
	cv (%)	72.853	72.853	72.853

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.018	.439	13.615
	Rep 2	.031	.742	22.990
	mean	.025	.590	18.302
	se	.006	.151	4.687
	cv (%)	36.218	36.218	36.218

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.014	.190	5.896
	Rep 2	.018	.245	7.586
	mean	.016	.217	6.741
	se	.002	.027	.845
	cv (%)	17.732	17.732	17.732

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.249	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.433
	Rep 2	-.497		Rep 2	.330
	mean	-.373		mean	.382
	se	.124		se	.052
	cv (%)	47.001		cv (%)	19.091

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
27 September 1973 (light), 26 September 1973 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.011	-.131	-3.944
	Rep 2	-.014	-.167	-5.019
	mean	-.013	-.149	-4.481
	se	.001	.018	.538
	cv (%)	16.971	16.970	16.971

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.032	.775	23.256
	Rep 2	.039	.941	28.224
	mean	.036	.858	25.740
	se	.003	.083	2.484
	cv (%)	13.643	13.648	13.648

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.021	.255	7.636
	Rep 2	.025	.301	9.034
	mean	.023	.278	8.335
	se	.092	.023	.699
	cv (%)	11.361	11.861	11.861

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.521	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.328
	Rep 2	-.640		Rep 2	.320
	mean	-.580		mean	.324
	se	.059		se	.004
	cv (%)	14.503		cv (%)	1.788

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
05 November 1973 (light), 06 November 1973 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.005	-.054	-1.619
	Rep 2	-.004	-.039	-1.161
	mean	-.005	-.046	-1.390
	se	.001	.008	.229
	cv (%)	23.311	23.311	23.311

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.015	.358	10.728
	Rep 2	.014	.326	9.792
	mean	.014	.342	10.260
	se	.001	.016	.468
	cv (%)	6.451	6.451	6.451

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.010	.098	2.932
	Rep 2	.010	.100	2.993
	mean	.010	.099	2.962
	se	.000	.001	.031
	cv (%)	1.459	1.457	1.456

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.260	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.273
	Rep 2	-.227		Rep 2	.306
	mean	-.243		mean	.289
	se	.017		se	.016
	cv (%)	9.680		cv (%)	7.891

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
11 December 1973 (light), 12 December 1973 (dark), B AVENUE, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.019	-.172	-5.333
	Rep 2	-.004	-.032	-.993
	mean	-.011	-.102	-3.163
	se	.008	.070	2.170
	cv (%)	97.029	97.029	97.029

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.011	.266	8.258
	Rep 2	.009	.214	6.622
	mean	.010	.240	7.440
	se	.001	.026	.818
	cv (%)	15.556	15.556	15.556

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	-.008	-.070	-2.184
	Rep 2	.005	.049	1.532
	mean	-.001	-.011	-.326
	se	.007	.060	1.858
	cv (%)	805.49	805.49	805.49

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.337	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	-.265
	Rep 2	-.164		Rep 2	.231
	mean	-.251		mean	-.017
	se	.086		se	.248
	cv (%)	48.740		cv (%)	2111.9

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan. 23 January 1974 (light), 22 January 1974 (dark), B AVENUE, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.000	.002	.060
	Rep 2	.000	.000	.000
	mean	.000	.001	.030
	se	.000	.001	.030
	cv (%)	141.42	141.42	141.42

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.011	.259	8.035
	Rep 2	.012	.298	9.226
	mean	.012	.278	8.630
	se	.001	.019	.595
	cv (%)	9.753	9.753	9.753

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.011	.106	3.301
	Rep 2	.012	.120	3.721
	mean	.012	.113	3.511
	se	.001	.007	.210
	cv (%)	8.461	8.461	8.461

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.153	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.411
	Rep 2	-.178		Rep 2	.403
	mean	-.165		mean	.407
	se	.012		se	.004
	cv (%)	10.661		cv (%)	1.303

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
05 March 1974 (light), 04 March 1974 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.004	-.051	-1.593
	Rep 2	.002	.027	.850
	mean	-.001	-.012	-.372
	se	.003	.039	1.221
	cv (%)	464.67	464.67	464.67

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.011	.266	8.258
	Rep 2	......	......	......
	mean	.011	.266	8.258
	se			
	cv (%)			

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.007	.075	2.337
	Rep 2	......	......	......
	mean	.007	.075	2.337
	se			
	cv (%)			

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.191	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.283
	Rep 2	......		Rep 2	......
	mean	-.191		mean	.283
	se			se	
	cv (%)			cv (%)	

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
09 April 1974 (light), 10 April 1974 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.006	-.078	-2.354
	Rep 2	-.011	-.149	-4.473
	mean	-.009	-.114	-3.414
	se	.003	.035	1.059
	cv (%)	43.889	43.889	43.889

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.025	.593	17.784
	Rep 2	.027	.638	19.152
	mean	.026	.616	18.468
	se	.001	.023	.684
	cv (%)	5.238	5.233	5.237

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.019	.245	7.338
	Rep 2	.015	.199	5.964
	mean	.017	.222	6.651
	se	.002	.023	.687
	cv (%)	14.601	14.601	14.601

		g 02/m2.da
NET DAILY METABOLISM	Rep 1	-.348
	Rep 2	-.440
	mean	-.394
	se	.046
	cv (%)	16.407

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.413
	Rep 2	.311
	mean	.362
	se	.051
	cv (%)	19.768

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
15 May 1974 (light), 16 May 1974 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.001	.018	.543
	Rep 2	.014	.212	6.563
	mean	.008	.115	3.553
	se	.007	.097	3.010
	cv (%)	119.80	119.80	119.80

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.025	.598	18.526
	Rep 2	.017	.410	12.722
	mean	.021	.504	15.624
	se	.004	.094	2.902
	cv (%)	26.264	26.264	26.264

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.026	.381	11.813
	Rep 2	.032	.461	14.302
	mean	.029	.421	13.058
	se	.003	.040	1.245
	cv (%)	13.480	13.480	13.480

		g 02/m2.da
NET DAILY METABOLISM	Rep 1	-.217
	Rep 2	.051
	mean	-.083
	se	.134
	cv (%)	228.58

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.638
	Rep 2	1.124
	mean	.881
	se	.243
	cv (%)	39.050

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
17 October 1974 (light), 18 October 1974 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.007	-.076	-2.357
	Rep 2	.005	.054	1.674
	Rep 3	-.003	-.036	-1.127
	mean	-.002	-.019	-.604
	se	.003	.038	1.193
	cv (%)	342.32	342.32	342.32

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.020	.490	15.178
	Rep 2	.022	.523	16.219
	Rep 3	.024	.574	17.782
	mean	.022	.529	16.393
	se	.001	.024	.757
	cv (%)	7.995	7.995	7.995

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.013	.149	4.612
	Rep 2	.027	.294	9.121
	Rep 3	.021	.227	7.037
	mean	.020	.223	6.923
	se	.004	.042	1.303
	cv (%)	32.597	32.597	32.597

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.341	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.304
	Rep 2	-.229		Rep 2	.562
	Rep 3	-.347		Rep 3	.396
	mean	-.305		mean	.421
	se	.033		se	.076
	cv (%)	21.700		cv (%)	31.147

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
09 January 1975 (light), 08 January 1975 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.001	-.010	-.316
	Rep 2	-.004	-.035	-1.093
	Rep 3	-.001	-.011	-.345
	mean	-.002	-.019	-.585
	se	.001	.008	.254
	cv (%)	75.285	75.285	75.285
		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.004	.103	3.199
	Rep 2	.015	.365	11.309
	Rep 3	.010	.240	7.440
	mean	.010	.236	7.316
	se	.003	.076	2.342
	cv (%)	55.443	55.443	55.443
		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.003	.030	.921
	Rep 2	.011	.106	3.280
	Rep 3	.009	.082	2.532
	mean	.008	.072	2.244
	se	.002	.022	.696
	cv (%)	53.724	53.724	53.724

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.074	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.288
	Rep 2	-.259		Rep 2	.290
	Rep 3	-.158		Rep 3	.340
	mean	-.164		mean	.306
	se	.054		se	.017
	cv (%)	56.763		cv (%)	9.704

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
16 April 1975 (light), 17 April 1975 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.015	.202	6.070
	Rep 2	-.002	-.034	-1.005
	Rep 3	.011	.150	4.502
	mean	.008	.106	3.189
	se	.005	.072	2.145
	cv (%)	116.52	116.52	116.52

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.030	.722	21.672
	Rep 2	.022	.523	15.696
	Rep 3	.022	.530	15.912
	mean	.025	.592	17.760
	se	.003	.065	1.957
	cv (%)	19.086	19.086	19.086

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.045	.606	18.170
	Rep 2	.019	.259	7.759
	Rep 3	.033	.446	13.387
	mean	.033	.437	13.105
	se	.007	.100	3.009
	cv (%)	39.767	39.767	39.767

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.117	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.838
	Rep 2	-.265		Rep 2	.494
	Rep 3	-.084		Rep 3	.841
	mean	-.155		mean	.725
	se	.036		se	.115
	cv (%)	61.969		cv (%)	27.531

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan. 14 July 1975 (light), 15 July 1975 (dark), B AVENUE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	-.001	-.009	-.279
	Rep 2	.001	.016	.512
	Rep 3	-.001	-.013	-.419
	mean	-.000	-.002	-.062
	se	.001	.009	.290
	cv (%)	808.93	808.93	808.93

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.040	.970	30.058
	Rep 2	.037	.886	27.454
	Rep 3	.038	.917	28.421
	mean	.039	.924	28.644
	se	.001	.025	.760
	cv (%)	4.595	4.595	4.595

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.040	.597	18.507
	Rep 2	.038	.570	17.670
	Rep 3	.037	.559	17.344
	mean	.038	.576	17.840
	se	.001	.011	.346
	cv (%)	3.361	3.362	3.362

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.373	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.616
	Rep 2	-.316		Rep 2	.644
	Rep 3	-.357		Rep 3	.610
	mean	-.349		mean	.623
	se	.017		se	.010
	cv (%)	8.465		cv (%)	2.868

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
30 October 1974 (light), 31 October 1974 (dark), UPPER 43, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.114	1.193	36.989
	Rep 2	.187	1.947	60.366
	mean	.151	1.570	48.677
	se	.036	.377	11.688
	cv (%)	33.958	33.958	33.958

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.099	2.374	73.582
	Rep 2	.100	2.395	74.251
	mean	.099	2.384	73.916
	se	.000	.011	.334
	cv (%)	.641	.640	.638

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.213	2.225	68.966
	Rep 2	.286	2.988	92.634
	mean	.250	2.606	80.800
	se	.037	.382	11.834
	cv (%)	20.712	20.712	20.712

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.149	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.937
	Rep 2	.593		Rep 2	1.248
	mean	.222		mean	1.092
	se	.371		se	.155
	cv (%)	236.25		cv (%)	20.085

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
21 January 1975 (light), 22 January 1975 (dark), UPPER 43, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.029	.281	8.720
	Rep 2	.013	.122	3.780
	Rep 3	.017	.166	5.148
	mean	.020	.190	5.883
	se	.005	.048	1.473
	cv (%)	43.358	43.358	43.358

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.021	.514	15.922
	Rep 2	.008	.197	6.101
	Rep 3	.019	.449	13.913
	mean	.016	.386	11.978
	se	.004	.097	2.995
	cv (%)	43.314	43.314	43.314

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.031	.487	15.088
	Rep 2	.021	.201	6.220
	Rep 3	.036	.346	10.714
	mean	.036	.344	10.674
	se	.009	.083	2.560
	cv (%)	41.544	41.544	41.544

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.027	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.948
	Rep 2	.004		Rep 2	1.020
	Rep 3	-.103		Rep 3	.770
	mean	-.042		mean	.912
	se	.032		se	.074
	cv (%)	130.37		cv (%)	14.071

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
27 May 1975 (light), 28 May 1975 (dark), UPPER 43, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.228	3.403	105.48
	Rep 2	.111	1.656	51.350
	Rep 3	.076	1.132	35.083
	mean	.138	2.064	63.972
	se	.046	.686	21.279
	cv (%)	57.615	57.615	57.615

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.089	2.141	66.365
	Rep 2	.069	1.656	51.336
	Rep 3	.080	1.915	59.371
	mean	.079	1.904	59.024
	se	.006	.140	4.342
	cv (%)	12.741	12.741	12.741

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.317	4.736	146.82
	Rep 2	.180	2.668	83.328
	Rep 3	.155	2.325	72.066
	mean	.217	3.250	100.74
	se	.050	.751	23.269
	cv (%)	40.008	40.008	40.008

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	2.595	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	2.212
	Rep 2	1.032		Rep 2	1.623
	Rep 3	.410		Rep 3	1.214
	mean	1.346		mean	1.683
	se	.659		se	.290
	cv (%)	83.693		cv (%)	29.822

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
21 July 1975 (light), 22 July 1975 (dark), UPPER 43, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.044	.657	20.352
	Rep 2	.110	1.633	50.628
	Rep 3	......	......	......
	mean	.077	1.145	35.490
	se	.033	.488	15.138
	cv (%)	60.321	60.321	60.321

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.085	2.030	62.942
	Rep 2	.102	2.450	75.962
	Rep 3	.126	3.026	93.818
	mean	.104	2.502	77.574
	se	.012	.289	8.949
	cv (%)	19.982	19.982	19.982

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.129	1.910	59.219
	Rep 2	.212	3.146	97.535
	Rep 3	......	......	......
	mean	.171	2.528	78.377
	se	.042	.618	19.158
	cv (%)	34.568	34.568	34.568

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.120	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.941
	Rep 2	.696		Rep 2	1.284
	Rep 3	......		Rep 3	......
	mean	.288		mean	1.112
	se	.408		se	.172
	cv (%)	200.42		cv (%)	21.816

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
08 August 1973 (light), 09 August 1973 (dark), NAGEL SITE, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.350	4.977	154.29
	Rep 2	.217	3.077	95.391
	mean	.284	4.027	124.84
	se	.067	.950	29.449
	cv (%)	33.361	33.361	33.361

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.072	1.735	53.791
	Rep 2	.115	2.748	85.188
	mean	.093	2.242	69.490
	se	.021	.506	15.698
	cv (%)	31.948	31.949	31.948

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.423	6.004	186.12
	Rep 2	.331	4.703	145.79
	mean	.377	5.353	165.96
	se	.046	.650	20.161
	cv (%)	17.180	17.181	17.181

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	4.269	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	3.460
	Rep 2	1.955		Rep 2	1.711
	mean	3.112		mean	2.586
	se	1.157		se	.874
	cv (%)	52.573		cv (%)	47.819

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
04 September 1973 (light), 05 September 1973 (dark), NAGEL SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.201	2.613	78.375
	Rep 2	.250	3.261	97.842
	mean	.225	2.937	88.109
	se	.025	.324	9.733
	cv (%)	15.623	15.623	15.623

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.113	2.712	81.360
	Rep 2	.107	2.561	76.824
	mean	.110	2.636	79.092
	se	.003	.076	2.268
	cv (%)	4.055	4.055	4.056

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.313	4.085	122.55
	Rep 2	.357	4.652	139.55
	mean	.335	4.368	131.05
	se	.022	.283	8.502
	cv (%)	9.175	9.175	9.175

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	1.373	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.506
	Rep 2	2.091		Rep 2	1.816
	mean	1.732		mean	1.661
	se	.359		se	.155
	cv (%)	29.315		cv (%)	13.207

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
04 October 1973 (light), 03 October 1973 (dark), NAGEL SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.115	1.334	41.353
	Rep 2	.123	1.432	44.379
	mean	.119	1.383	42.866
	se	.004	.049	1.513
	cv (%)	4.991	4.991	4.991
		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.051	1.229	38.093
	Rep 2	.059	1.421	44.045
	mean	.055	1.325	41.069
	se	.004	.096	2.976
	cv (%)	10.248	10.248	10.248
		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.166	1.929	59.797
	Rep 2	.182	2.119	65.704
	mean	.174	2.024	62.750
	se	.008	.095	2.954
	cv (%)	6.657	6.657	6.657

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	.700	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.570
	Rep 2	.699		Rep 2	1.492
	mean	.699		mean	1.531
	se	.001		se	.039
	cv (%)	.148		cv (%)	3.603

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
12 November 1973 (light), 13 November 1973 (dark), NAGEL SITE, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.252	2.501	75.025
	Rep 2	.238	2.362	70.859
	mean	.245	2.431	72.942
	se	.007	.069	2.083
	cv (%)	4.039	4.039	4.039

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.079	1.884	56.520
	Rep 2	.061	1.469	44.064
	mean	.070	1.676	50.292
	se	.009	.208	6.228
	cv (%)	17.513	17.513	17.513

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.331	3.280	98.387
	Rep 2	.299	2.969	89.072
	mean	.315	3.124	93.729
	se	.016	.155	4.657
	cv (%)	7.027	7.027	7.027

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	1.396	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.741
	Rep 2	1.500		Rep 2	2.021
	mean	1.448		mean	1.881
	se	.052		se	.140
	cv (%)	5.113		cv (%)	10.552

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
18 December 1973 (light), 19 December 1973 (dark), NAGEL SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.139	1.262	39.127
	Rep 2	.076	.690	21.383
	mean	.107	.976	30.255
	se	.031	.286	8.872
	cv (%)	41.470	41.470	41.470

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.036	.876	27.156
	Rep 2	.025	.588	18.228
	mean	.031	.732	22.692
	se	.006	.144	4.464
	cv (%)	27.821	27.820	27.821

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.175	1.594	49.424
	Rep 2	.100	.913	28.295
	mean	.138	1.254	38.859
	se	.037	.341	10.565
	cv (%)	38.448	38.448	38.448

		g 02/m2.da
NET DAILY METABOLISM	Rep 1	.718
	Rep 2	.325
	mean	.521
	se	.197
	cv (%)	53.369

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.820
	Rep 2	1.552
	mean	1.686
	se	.134
	cv (%)	11.226

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan. 20 March 1974 (light), 21 March 1974 (dark), NAGEL SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.177	2.142	66.407
	Rep 2	.141	1.705	52.870
	mean	.159	1.924	59.638
	se	.018	.218	6.769
	cv (%)	16.050	16.050	16.050

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.073	1.762	54.610
	Rep 2	.054	1.289	39.953
	mean	.064	1.525	47.281
	se	.010	.236	7.328
	cv (%)	21.920	21.920	21.920

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.250	3.032	94.007
	Rep 2	.194	2.357	73.063
	mean	.222	2.695	83.535
	se	.028	.338	10.472
	cv (%)	17.729	17.729	17.729

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	1.271	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.721
	Rep 2	1.068		Rep 2	1.829
	mean	1.170		mean	1.775
	se	.101		se	.054
	cv (%)	12.262		cv (%)	4.274

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
23 April 1974 (light), 22 April 1974 (dark), NAGEL SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.155	2.122	63.675
	Rep 2	.082	1.122	33.669
	mean	.118	1.622	48.672
	se	.036	.500	15.003
	cv (%)	43.592	43.592	43.592

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.127	3.038	91.152
	Rep 2	.151	3.634	109.01
	mean	.139	3.336	100.08
	se	.012	.298	8.928
	cv (%)	12.616	12.616	12.616

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.281	3.859	115.78
	Rep 2	.233	3.200	95.985
	mean	.257	3.529	105.88
	se	.024	.330	9.899
	cv (%)	13.221	13.221	13.221

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	.821	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.270
	Rep 2	-.434		Rep 2	.889
	mean	.193		mean	1.075
	se	.628		se	.195
	cv (%)	458.77		cv (%)	25.625

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
24 April 1974 (light), 22 April 1974 (dark), NAGEL SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.251	3.454	103.61
	Rep 2	.124	1.713	51.390
	mean	.188	2.583	77.498
	se	.063	.870	26.108
	cv (%)	47.643	47.643	47.643

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.127	3.038	91.152
	Rep 2	.151	3.634	109.01
	mean	.139	3.336	100.08
	se	.012	.298	8.928
	cv (%)	12.616	12.616	12.616

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.377	5.197	155.90
	Rep 2	.276	3.798	113.93
	mean	.327	4.497	134.92
	se	.051	.700	20.985
	cv (%)	21.997	21.997	21.997

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	2.158	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.710
	Rep 2	.164		Rep 2	1.045
	mean	1.161		mean	1.378
	se	.997		se	.333
	cv (%)	121.43		cv (%)	34.139

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
29 May 1974 (light), 29 May 1974 (dark), NAGEL SITE, DIEL RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.128	1.915	59.381
	Rep 2	.173	2.600	80.585
	mean	.150	2.258	69.982
	se	.023	.342	10.602
	cv (%)	21.425	21.425	21.425

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.113	2.719	84.295
	Rep 2	.119	2.868	88.908
	mean	.116	2.794	86.602
	se	.003	.074	2.306
	cv (%)	3.766	3.767	3.766

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.241	3.615	112.06
	Rep 2	.293	4.392	136.15
	mean	.267	4.003	124.11
	se	.026	.389	12.043
	cv (%)	13.724	13.724	13.723

		g 02/m2.da
NET DAILY METABOLISM	Rep 1	.896
	Rep 2	1.524
	mean	1.210
	se	.314
	cv (%)	36.714

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.329
	Rep 2	1.531
	mean	1.430
	se	.101
	cv (%)	9.986

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
01 July 1974 (light), 01 July 1974 (dark), NAGEL SITE, DIEL RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.133	2.032	62.982
	mean	.133	2.032	62.982
	se			
	cv (%)			

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.153	3.672	113.83
	mean	.153	3.672	113.83
	se			
	cv (%)			

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.286	4.362	135.22
	mean	.286	4.362	135.22
	se			
	cv (%)			

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	.690	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.188
	mean	.690		mean	1.188
	se			se	
	cv (%)			cv (%)	

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
05 August 1974 (light), 05 August 1974 (dark), NAGEL SITE, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.251	3.564	111.09
	Rep 2	.163	2.332	72.302
	Rep 3	......	......	......
	mean	.207	2.958	91.697
	se	.044	.626	19.394
	cv (%)	29.911	29.911	29.911

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.094	2.249	69.713
	Rep 2	......	......	......
	Rep 3	.091	2.179	67.555
	mean	.092	2.214	68.634
	se	.001	.035	1.079
	cv (%)	2.224	2.223	2.223

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.344	4.923	152.63
	Rep 2	......	......	......
	Rep 3	......	......	......
	mean	.344	4.923	152.63
	se			
	cv (%)			

		g O2/m2.da
NET DAILY METABOLISM	Rep 1	2.675
	Rep 2	......
	Rep 3	......
	mean	2.675
	se	
	cv (%)	

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	2.189
	Rep 2	......
	Rep 3	......
	mean	2.189
	se	
	cv (%)	

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
06 November 1974 (light), 07 November 1974 (dark), NAGEL SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.121	1.225	36.742
	Rep 2	.197	1.991	59.716
	Rep 3	.083	.844	25.315
	mean	.134	1.353	40.591
	se	.033	.337	10.116
	cv (%)	43.164	43.164	43.164

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.031	.744	22.320
	Rep 2	.066	1.572	47.160
	Rep 3	.027	.660	19.800
	mean	.041	.992	29.760
	se	.012	.291	8.730
	cv (%)	50.811	50.811	50.811

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.152	1.539	46.162
	Rep 2	.262	2.654	79.622
	Rep 3	.111	1.122	33.672
	mean	.175	1.772	53.152
	se	.045	.457	13.717
	cv (%)	44.700	44.700	44.700

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	.795	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	2.068
	Rep 2	1.082		Rep 2	1.688
	Rep 3	.462		Rep 3	1.701
	mean	.780		mean	1.819
	se	.179		se	.125
	cv (%)	39.773		cv (%)	11.868

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
30 January 1975 (light), 31 January 1975 (dark), NAGEL SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.021	.212	6.557
	Rep 2	.032	.315	9.758
	Rep 3	.028	.278	8.619
	mean	.027	.268	8.311
	se	.003	.030	.937
	cv (%)	19.525	19.524	19.525

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.031	.746	23.138
	Rep 2	.023	.554	17.186
	Rep 3	.024	.586	18.154
	mean	.026	.629	19.493
	se	.002	.059	1.844
	cv (%)	16.385	16.385	16.385

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.052	.520	16.130
	Rep 2	.055	.544	16.869
	Rep 3	.052	.520	16.130
	mean	.053	.528	16.377
	se	.001	.008	.246
	cv (%)	2.605	2.604	2.604

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	-.226	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.697
	Rep 2	-.010		Rep 2	.982
	Rep 3	-.065		Rep 3	.888
	mean	-.101		mean	.856
	se	.065		se	.084
	cv (%)	111.58		cv (%)	16.946

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
31 January 1974 (light), 01 February 1974 (dark), NAGEL SITE, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.057	.573	17.772
	Rep 2	.027	.265	8.221
	mean	.042	.419	12.996
	se	.015	.154	4.775
	cv (%)	51.961	51.961	51.961

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.021	.504	15.624
	Rep 2	.027	.660	20.460
	mean	.024	.582	18.042
	se	.003	.078	2.418
	cv (%)	18.953	18.953	18.954

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.079	.783	24.262
	Rep 2	.054	.539	16.721
	mean	.066	.661	20.491
	se	.012	.122	3.771
	cv (%)	26.023	26.023	26.023

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	.279	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.553
	Rep 2	-.121		Rep 2	.817
	mean	.079		mean	1.185
	se	.200		se	.368
	cv (%)	357.31		cv (%)	43.898

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
24 July 1975 (light), 25 July 1975 (dark), NAGEL SITE, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.109	1.606	49.773
	Rep 2	.052	.759	23.516
	Rep 3	.106	1.557	48.266
	mean	.089	1.307	40.518
	se	.019	.275	8.512
	cv (%)	36.387	36.367	36.387

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.130	3.115	96.571
	Rep 2	.113	2.722	84.370
	Rep 3	.098	2.342	72.614
	mean	.114	2.726	84.518
	se	.009	.223	6.916
	cv (%)	14.173	14.173	14.173

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.239	3.518	109.04
	Rep 2	.165	2.429	75.298
	Rep 3	.203	2.995	92.833
	mean	.202	2.980	92.391
	se	.021	.314	9.744
	cv (%)	18.267	18.266	18.266

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	.402	**GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION**	Rep 1	1.129
	Rep 2	-.293		Rep 2	.893
	Rep 3	.652		Rep 3	1.278
	mean	.254		mean	1.100
	se	.283		se	.112
	cv (%)	192.76		cv (%)	17.690

Table A-1 (con't). Estimates of Community Metabolism (g O2/m2), Augusta Creek, Michigan.
26 November 1974 (light), 27 November 1974 (dark), KELLOGG FOREST, STANDARD RUN

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.061	.576	17.293
	Rep 2	.133	1.257	37.705
	Rep 3	.046	.430	12.899
	mean	.080	.754	22.633
	se	.027	.255	7.642
	cv (%)	58.486	58.486	58.486

		g O2/m2.hr	g O2/m2.da	g O2/m2.mo
COMMUNITY RESPIRATION	Rep 1	.020	.470	14.112
	Rep 2	.025	.610	18.288
	Rep 3	.011	.252	7.560
	mean	.019	.444	13.320
	se	.004	.104	3.122
	cv (%)	40.598	40.598	40.598

		g O2/m2.hr	g O2/m2.da	g C2/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.081	.762	22.850
	Rep 2	.158	1.497	44.906
	Rep 3	.056	.529	15.876
	mean	.098	.929	27.878
	se	.031	.292	8.749
	cv (%)	54.360	54.360	54.360

		g O2/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	.291	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.619
	Rep 2	.887		Rep 2	2.456
	Rep 3	.277		Rep 3	2.100
	mean	.485		mean	2.058
	se	.201		se	.242
	cv (%)	71.763		cv (%)	20.392

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
06 February 1975 (light), 05 February 1975 (dark), KELLOGG FOREST, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	......	......	......
	Rep 2	.034	.346	9.682
	Rep 3	.042	.426	11.938
	mean	.038	.386	10.810
	se	.004	.040	1.128
	cv (%)	14.759	14.759	14.758

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.013	.302	8.467
	Rep 2	.014	.338	9.475
	Rep 3	.013	.317	8.870
	mean	.013	.319	8.938
	se	.000	.010	.293
	cv (%)	5.676	5.677	5.677

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	......	......	......
	Rep 2	.048	.490	13.709
	Rep 3	.055	.561	15.708
	mean	.052	.525	14.708
	se	.003	.036	1.000
	cv (%)	9.611	9.611	9.611

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	......	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	......
	Rep 2	.151		Rep 2	1.447
	Rep 3	.244		Rep 3	1.771
	mean	.198		mean	1.609
	se	.047		se	.162
	cv (%)	33.263		cv (%)	14.241

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
13 May 1975 (light), 14 May 1975 (dark), KELLOGG FOREST, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.087	1.265	39.205
	Rep 2	.107	1.555	48.208
	Rep 3	.077	1.114	34.524
	mean	.090	1.311	40.646
	se	.009	.130	4.015
	cv (%)	17.110	17.110	17.110

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.047	1.135	35.191
	Rep 2	.037	.881	27.305
	Rep 3	.020	.487	15.103
	mean	.035	.834	25.866
	se	.008	.188	5.843
	cv (%)	39.128	39.128	39.128

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.134	1.951	60.496
	Rep 2	.144	2.088	64.727
	Rep 3	.097	1.408	43.662
	mean	.125	1.816	56.295
	se	.014	.208	6.434
	cv (%)	19.795	19.795	19.795

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	.816	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.719
	Rep 2	1.207		Rep 2	2.371
	Rep 3	.921		Rep 3	2.891
	mean	.982		mean	2.327
	se	.117		se	.339
	cv (%)	20.612		cv (%)	25.232

Table A-1 (con't). Estimates of Community Metabolism (g 02/m2), Augusta Creek, Michigan.
28 July 1975 (light), 29 July 1975 (dark), KELLOGG FOREST, STANDARD RUN

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
NET COMMUNITY PRODUCTIVITY	Rep 1	.079	1.150	35.665
	Rep 2	.116	1.694	52.502
	Rep 3	.073	1.063	32.949
	mean	.089	1.302	40.372
	se	.014	.197	6.115
	cv (%)	26.236	26.236	26.236

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
COMMUNITY RESPIRATION	Rep 1	.077	1.843	57.139
	Rep 2	.027	.660	20.460
	Rep 3	.073	1.740	53.940
	mean	.059	1.414	43.846
	se	.016	.378	11.730
	cv (%)	46.335	46.335	46.335

		g 02/m2.hr	g 02/m2.da	g 02/m2.mo
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.156	2.272	70.425
	Rep 2	.144	2.095	64.948
	Rep 3	.145	2.121	65.763
	mean	.148	2.163	67.045
	se	.004	.055	1.706
	cv (%)	4.407	4.407	4.407

		g 02/m2.da			PG/R24
NET DAILY METABOLISM	Rep 1	.429	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.233
	Rep 2	1.435		Rep 2	3.174
	Rep 3	.381		Rep 3	1.219
	mean	.748		mean	1.875
	se	.344		se	.650
	cv (%)	79.533		cv (%)	59.989

Table A-2. Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 15 January 1975 (light), 16 January 1975 (dark), SMITH SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	517.20	-.000	-.000	-.004
	Rep 2	423.10	-.000	-.000	-.005
	Rep 3	379.30	-.000	-.000	-.005
	mean	439.87	-.000	-.000	-.005
	se	40.682	.000	.000	.000
	cv (%)	16.019	16.294	16.294	16.294

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	517.20	.000	.001	.016
	Rep 2	423.10	.000	.001	.034
	Rep 3	379.30	.000	.001	.039
	mean	439.87	.000	.001	.030
	se	40.682	.000	.000	.007
	cv (%)	16.019	39.833	39.833	39.833

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	517.20	.000	.000	.003
	Rep 2	423.10	.000	.000	.008
	Rep 3	379.30	.000	.000	.010
	mean	439.87	.000	.000	.007
	se	40.682	.000	.000	.002
	cv (%)	16.019	57.222	57.222	57.222

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.000	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.157
	Rep 2	-.001		Rep 2	.235
	Rep 3	-.001		Rep 3	.265
	mean	-.001		mean	.219
	se	.000		se	.032
	cv (%)	34.619		cv (%)	25.656

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
20 May 1975 (light), 21 May 1975 (dark), SMITH SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	86.630	-.000	-.001	-.036
	Rep 2	426.30	-.000	-.000	-.005
	Rep 3	247.10	-.000	-.001	-.018
	mean	253.34	-.000	-.001	-.019
	se	98.104	.000	.000	.009
	cv (%)	67.071	80.967	80.967	80.967

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	86.630	.000	.006	.176
	Rep 2	426.30	.000	.002	.049
	Rep 3	247.10	.000	.001	.026
	mean	253.34	.000	.003	.084
	se	98.104	.000	.002	.047
	cv (%)	67.071	96.035	96.035	96.035

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	86.630	.000	.002	.072
	Rep 2	426.30	.000	.001	.026
	Rep 3	247.10	-.000	-.000	-.002
	mean	253.34	.000	.001	.032
	se	98.104	.000	.001	.022
	cv (%)	67.071	116.40	116.40	116.40

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.003	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.411
	Rep 2	-.001		Rep 2	.523
	Rep 3	-.001		Rep 3	-.063
	mean	-.002		mean	.290
	se	.001		se	.180
	cv (%)	86.978		cv (%)	107.13

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 17 July 1975.(light), 18 July 1975 (dark), SMITH SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	497.50	-.000	-.001	-.018
	Rep 2	286.10	-.000	-.001	-.019
	Rep 3	355.80	-.000	-.001	-.020
	mean	379.80	-.000	-.001	-.019
	se	62.195	.000	.000	.001
	cv (%)	28.363	4.762	4.763	4.763

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	497.50	.000	.001	.041
	Rep 2	286.10	.000	.001	.041
	Rep 3	355.80	.000	.002	.049
	mean	379.80	.000	.001	.044
	se	62.195	.000	.000	.003
	cv (%)	28.363	10.484	10.484	10.484

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	497.50	.000	.000	.008
	Rep 2	286.10	.000	.000	.007
	Rep 3	355.80	.000	.000	.011
	mean	379.80	.000	.000	.008
	se	62.195	.000	.000	.001
	cv (%)	28.363	26.226	26.226	26.226

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.001	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.189
	Rep 2	-.001		Rep 2	.161
	Rep 3	-.001		Rep 3	.222
	mean	-.001		mean	.191
	se	.000		se	.018
	cv (%)	7.085		cv (%)	15.985

Table A-2. Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
02 August 1973 (light), 01 August 1973 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	253.60	.000	.000	.010
	Rep 2	243.60	.000	.000	.010
	mean	248.60	.000	.000	.010
	se	5.000	.000	.000	.000
	cv (%)	2.844	2.844	2.844	2.845

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	253.60	.000	.002	.073
	Rep 2	243.60	.000	.004	.114
	mean	248.60	.000	.003	.093
	se	5.000	.000	.001	.020
	cv (%)	2.844	30.463	30.463	30.463

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	253.60	.000	.002	.054
	Rep 2	243.60	.000	.003	.079
	mean	248.60	.000	.002	.066
	se	5.000	.000	.000	.012
	cv (%)	2.844	26.199	26.199	26.199

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.001	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.738
	Rep 2	-.001		Rep 2	.693
	mean	-.001		mean	.715
	se	.000		se	.022
	cv (%)	40.935		cv (%)	4.438

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
29 August 1973 (light), 30 August 1973 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	260.80	-.000	-.000	-.006
	Rep 2	270.00	-.000	-.001	-.019
	mean	265.40	-.000	-.000	-.013
	se	4.600	.000	.000	.006
	cv (%)	2.451	71.037	71.037	71.036

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	260.80	.000	.002	.052
	Rep 2	270.00	.000	.003	.085
	mean	265.40	.000	.002	.069
	se	4.600	.000	.001	.016
	cv (%)	2.451	33.917	33.917	33.917

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	260.80	.000	.001	.023
	Rep 2	270.00	.000	.001	.028
	mean	265.40	.000	.001	.025
	se	4.600	.000	.000	.003
	cv (%)	2.451	15.314	15.314	15.314

		g 02/da.g AFDW
NET DAILY METABOLISM	Rep 1	-.001
	Rep 2	-.002
	mean	-.001
	se	.000
	cv (%)	44.808

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.433
	Rep 2	.330
	mean	.382
	se	.052
	cv (%)	19.091

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
27 September 1973 (light), 26 September 1973 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	331.50	-.000	-.000	-.012
	Rep 2	99.250	-.000	-.002	-.051
	mean	215.37	-.000	-.001	-.031
	se	116.12	.000	.001	.019
	cv (%)	76.251	87.557	87.557	87.557

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	331.50	.000	.002	.070
	Rep 2	99.250	.000	.009	.284
	mean	215.37	.000	.006	.177
	se	116.12	.000	.004	.107
	cv (%)	76.251	85.452	85.452	85.452

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	331.50	.000	.001	.023
	Rep 2	99.250	.000	.003	.091
	mean	215.37	.000	.002	.057
	se	116.12	.000	.001	.034
	cv (%)	76.251	84.300	84.300	84.300

		g O2/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.002	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.328
	Rep 2	-.006		Rep 2	.320
	mean	-.004		mean	.324
	se	.002		se	.004
	cv (%)	85.999		cv (%)	1.788

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
05 November 1973 (light), 06 November 1973 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	140.00	-.000	-.000	-.012
	Rep 2	244.20	-.000	-.000	-.005
	mean	192.10	-.000	-.000	-.008
	se	52.100	.000	.000	.003
	cv (%)	38.355	59.028	59.028	59.028

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	140.00	.000	.003	.077
	Rep 2	244.20	.000	.001	.040
	mean	192.10	.000	.002	.058
	se	52.100	.000	.001	.018
	cv (%)	38.355	44.259	44.259	44.259

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	140.00	.000	.001	.021
	Rep 2	244.20	.000	.000	.012
	mean	192.10	.000	.001	.017
	se	52.100	.000	.000	.004
	cv (%)	38.355	37.001	37.001	37.001

		g O2/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.002	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.273
	Rep 2	-.001		Rep 2	.306
	mean	-.001		mean	.289
	se	.000		se	.016
	cv (%)	47.160		cv (%)	7.891

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
11 December 1973 (light), 12 December 1973 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	193.20	-.000	-.001	-.028
	Rep 2	304.40	-.000	-.000	-.003
	mean	248.80	-.000	-.000	-.015
	se	55.600	.000	.000	.012
	cv (%)	31.604	111.53	111.53	111.53

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	193.20	.000	.001	.043
	Rep 2	304.40	.000	.001	.022
	mean	248.80	.000	.001	.032
	se	55.600	.000	.000	.010
	cv (%)	31.604	46.029	46.029	46.029

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	193.20	-.000	-.000	-.011
	Rep 2	304.40	.000	.000	.005
	mean	248.80	-.000	-.000	-.003
	se	55.600	.000	.000	.008
	cv (%)	31.604	368.30	368.30	368.30

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.002	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	-.265
	Rep 2	-.001		Rep 2	.231
	mean	-.001		mean	-.017
	se	.001		se	.248
	cv (%)	74.598		cv (%)	2111.9

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
23 January 1974 (light), 22 January 1974 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	217.50	.000	.000	.000
	Rep 2	267.70	.000	.000	.000
	mean	242.60	.000	.000	.000
	se	25.100	.000	.000	.000
	cv (%)	14.632	141.42	141.42	141.42

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	217.50	.000	.001	.037
	Rep 2	267.70	.000	.001	.034
	mean	242.60	.000	.001	.036
	se	25.100	.000	.000	.001
	cv (%)	14.632	4.914	4.913	4.913

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	217.50	.000	.000	.015
	Rep 2	267.70	.000	.000	.014
	mean	242.60	.000	.000	.015
	se	25.100	.000	.000	.001
	cv (%)	14.632	6.209	6.209	6.209

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.001	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.411
	Rep 2	-.001		Rep 2	.403
	mean	-.001		mean	.407
	se	.000		se	.004
	cv (%)	4.002		cv (%)	1.303

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 05 March 1974 (light), 04 March 1974 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	115.00	-.000	-.000	-.014
	Rep 2	316.40	.000	.000	.003
	mean	215.70	-.000	-.000	-.006
	se	100.70	.000	.000	.008
	cv (%)	66.023	209.43	209.43	209.43

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	115.00	.000	.002	.072
	Rep 2	316.40	......	......	......
	mean	215.70	.000	.002	.072
	se	100.70			
	cv (%)	66.023			

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	115.00	.000	.001	.020
	Rep 2	316.40	......	......	......
	mean	215.70	.000	.001	.020
	se	100.70			
	cv (%)	66.023			

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.002	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.283
	Rep 2	......		Rep 2	......
	mean	......		mean	.283
	se	......		se	
	cv (%)	......		cv (%)	

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
09 April 1974 (light), 10 April 1974 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	228.30	-.000	-.000	-.010
	Rep 2	412.30	-.000	-.000	-.011
	mean	320.30	-.000	-.000	-.011
	se	92.000	.000	.000	.000
	cv (%)	40.621	3.589	3.588	3.589

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	228.30	.000	.003	.078
	Rep 2	412.30	.000	.002	.046
	mean	320.30	.000	.002	.062
	se	92.000	.000	.001	.016
	cv (%)	40.621	35.763	35.763	35.763

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	228.30	.000	.001	.032
	Rep 2	412.30	.000	.000	.014
	mean	320.30	.000	.001	.023
	se	92.000	.000	.000	.009
	cv (%)	40.621	53.631	53.631	53.631

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.002	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.413
	Rep 2	-.001		Rep 2	.311
	mean	-.001		mean	.362
	se	.000		se	.051
	cv (%)	25.048		cv (%)	19.768

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
15 May 1974 (light), 16 May 1974 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	322.80	.000	.000	.002
	Rep 2	230.80	.000	.001	.028
	mean	276.80	.000	.000	.015
	se	46.000	.000	.000	.013
	cv (%)	23.502	125.62	125.62	125.62

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	322.80	.000	.002	.057
	Rep 2	230.80	.000	.002	.055
	mean	276.80	.000	.002	.056
	se	46.000	.000	.000	.001
	cv (%)	23.502	2.850	2.849	2.850

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	322.80	.000	.001	.037
	Rep 2	230.80	.000	.002	.062
	mean	276.80	.000	.002	.049
	se	46.000	.000	.000	.013
	cv (%)	23.502	36.406	36.406	36.406

		g 02/da.g AFDW
NET DAILY METABOLISM	Rep 1	-.001
	Rep 2	.000
	mean	-.000
	se	.000
	cv (%)	280.40

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.638
	Rep 2	1.124
	mean	.881
	se	.243
	cv (%)	39.050

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 17 October 1974 (light), 18 October 1974 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	623.90	-.000	-.000	-.004
	Rep 2	639.40	.000	.000	.003
	Rep 3	512.70	-.000	-.000	-.002
	mean	592.00	-.000	-.000	-.001
	se	39.902	.000	.000	.002
	cv (%)	11.674	297.57	297.57	297.57

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	623.90	.000	.001	.024
	Rep 2	639.40	.000	.001	.025
	Rep 3	512.70	.000	.001	.035
	mean	592.00	.000	.001	.028
	se	39.902	.000	.000	.003
	cv (%)	11.674	20.275	20.275	20.275

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	623.90	.000	.000	.007
	Rep 2	639.40	.000	.000	.014
	Rep 3	512.70	.000	.000	.014
	mean	592.00	.000	.000	.012
	se	39.902	.000	.000	.002
	cv (%)	11.674	32.406	32.407	32.407

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.001	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.304
	Rep 2	-.000		Rep 2	.562
	Rep 3	-.001		Rep 3	.396
	mean	-.001		mean	.421
	se	.000		se	.076
	cv (%)	30.339		cv (%)	31.147

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
09 January 1975 (light), 08 January 1975 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	166.90	-.000	-.000	-.002
	Rep 2	88.630	-.000	-.000	-.012
	Rep 3	275.40	-.000	-.000	-.001
	mean	176.98	-.000	-.000	-.005
	se	54.151	.000	.000	.004
	cv (%)	52.997	120.52	120.52	120.52

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	166.90	.000	.001	.019
	Rep 2	88.630	.000	.004	.128
	Rep 3	275.40	.000	.001	.027
	mean	176.98	.000	.002	.058
	se	54.151	.000	.001	.035
	cv (%)	52.997	104.38	104.38	104.38

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	166.90	.000	.000	.006
	Rep 2	88.630	.000	.001	.037
	Rep 3	275.40	.000	.000	.009
	mean	176.98	.000	.001	.017
	se	54.151	.000	.000	.010
	cv (%)	52.997	99.879	99.879	99.879

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.000	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.288
	Rep 2	-.003		Rep 2	.290
	Rep 3	-.001		Rep 3	.340
	mean	-.001		mean	.306
	se	.001		se	.017
	cv (%)	106.34		cv (%)	9.704

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 16 April 1975 (light), 17 April 1975 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	135.80	.000	.001	.045
	Rep 2	115.90	-.000	-.000	-.009
	Rep 3	183.20	.000	.001	.025
	mean	144.97	.000	.001	.020
	se	19.961	.000	.001	.016
	cv (%)	23.849	133.42	133.42	133.42

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	135.80	.000	.005	.160
	Rep 2	115.90	.000	.005	.135
	Rep 3	183.20	.000	.003	.087
	mean	144.97	.000	.004	.127
	se	19.961	.000	.001	.021
	cv (%)	23.849	29.101	29.101	29.101

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	135.80	.000	.004	.134
	Rep 2	115.90	.000	.002	.067
	Rep 3	183.20	.000	.002	.073
	mean	144.97	.000	.003	.091
	se	19.961	.000	.001	.021
	cv (%)	23.849	40.494	40.494	40.494

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.001	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.838
	Rep 2	-.002		Rep 2	.494
	Rep 3	-.000		Rep 3	.841
	mean	-.001		mean	.725
	se	.001		se	.115
	cv (%)	79.824		cv (%)	27.531

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
14 July 1975 (light), 15 July 1975 (dark), B AVENUE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	367.20	-.000	-.000	-.001
	Rep 2	248.10	.000	.000	.002
	Rep 3	375.30	-.000	-.000	-.001
	mean	330.20	.000	.000	.000
	se	41.116	.000	.000	.001
	cv (%)	21.567	2796.1	2796.1	2796.1

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	367.20	.000	.003	.082
	Rep 2	248.10	.000	.004	.111
	Rep 3	375.30	.000	.002	.076
	mean	330.20	.000	.003	.089
	se	41.116	.000	.000	.011
	cv (%)	21.567	20.858	20.858	20.858

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	367.20	.000	.002	.050
	Rep 2	248.10	.000	.002	.071
	Rep 3	375.30	.000	.001	.046
	mean	330.20	.000	.002	.056
	se	41.116	.000	.000	.008
	cv (%)	21.567	23.941	23.941	23.941

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.001	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.616
	Rep 2	-.001		Rep 2	.644
	Rep 3	-.001		Rep 3	.610
	mean	-.001		mean	.623
	se	.000		se	.010
	cv (%)	15.709		cv (%)	2.868

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
30 October 1974 (light), 31 October 1974 (dark), UPPER 43, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	263.10	.000	.005	.141
	Rep 2	173.60	.001	.011	.348
	mean	218.35	.001	.008	.244
	se	44.750	.000	.003	.104
	cv (%)	28.984	59.990	59.990	59.990

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	263.10	.000	.009	.280
	Rep 2	173.60	.001	.014	.428
	mean	218.35	.000	.011	.354
	se	44.750	.000	.002	.074
	cv (%)	28.984	29.597	29.597	29.597

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	263.10	.001	.008	.262
	Rep 2	173.60	.002	.017	.534
	mean	218.35	.001	.013	.398
	se	44.750	.000	.004	.136
	cv (%)	28.984	48.248	48.248	48.248

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.001	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.937
	Rep 2	.003		Rep 2	1.248
	mean	.001		mean	1.092
	se	.002		se	.155
	cv (%)	197.59		cv (%)	20.085

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
21 January 1975 (light), 22 January 1975 (dark), UPPER 43, STANDARD RUN

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	301.40	.000	.001	.029
	Rep 2	180.10	.000	.001	.021
	Rep 3	223.60	.000	.001	.023
	mean	235.03	.000	.001	.024
	se	35.480	.000	.000	.002
	cv (%)	26.146	16.970	16.971	16.971

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	301.40	.000	.002	.053
	Rep 2	180.10	.000	.001	.034
	Rep 3	223.60	.000	.002	.062
	mean	235.03	.000	.002	.050
	se	35.480	.000	.000	.008
	cv (%)	26.146	29.088	29.088	29.088

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	301.40	.000	.002	.050
	Rep 2	180.10	.000	.001	.035
	Rep 3	223.60	.000	.002	.048
	mean	235.03	.000	.001	.044
	se	35.480	.000	.000	.005
	cv (%)	26.146	19.046	19.046	19.046

		g O2/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.000	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.948
	Rep 2	.000		Rep 2	1.020
	Rep 3	-.000		Rep 3	.770
	mean	-.000		mean	.912
	se	.000		se	.074
	cv (%)	143.23		cv (%)	14.071

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
27 May 1975 (light), 28 May 1975 (dark), UPPER 43, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	182.30	.001	.019	.579
	Rep 2	180.90	.001	.009	.284
	Rep 3	174.10	.000	.007	.202
	mean	179.10	.001	.011	.355
	se	2.532	.000	.004	.114
	cv (%)	2.449	55.904	55.904	55.904

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	182.30	.000	.012	.364
	Rep 2	180.90	.000	.009	.284
	Rep 3	174.10	.000	.011	.341
	mean	179.10	.000	.011	.330
	se	2.532	.000	.001	.024
	cv (%)	2.449	12.538	12.538	12.538

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	182.30	.002	.026	.805
	Rep 2	180.90	.001	.015	.461
	Rep 3	174.10	.001	.013	.414
	mean	179.10	.001	.018	.560
	se	2.532	.000	.004	.123
	cv (%)	2.449	38.180	38.179	38.180

		g 02/da.g AFDW
NET DAILY METABOLISM	Rep 1	.014
	Rep 2	.006
	Rep 3	.002
	mean	.007
	se	.004
	cv (%)	82.457

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	2.212
	Rep 2	1.623
	Rep 3	1.214
	mean	1.683
	se	.290
	cv (%)	29.822

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 21 July 1975 (light), 22 July 1975 (dark), UPPER 43, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	347.20	.000	.002	.059
	Rep 2	376.60	.000	.004	.134
	Rep 3	260.30	......	......	......
	mean	328.03	.000	.003	.097
	se	34.914	.000	.001	.038
	cv (%)	18.435	55.539	55.539	55.539

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	347.20	.000	.006	.181
	Rep 2	376.60	.000	.007	.202
	Rep 3	260.30	.000	.012	.360
	mean	328.03	.000	.008	.248
	se	34.914	.000	.002	.057
	cv (%)	18.435	39.573	39.573	39.573

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	347.20	.000	.006	.171
	Rep 2	376.60	.001	.008	.259
	Rep 3	260.30	......	......	......
	mean	328.03	.000	.007	.215
	se	34.914	.000	.001	.044
	cv (%)	18.435	29.112	29.113	29.112

		g 02/da.g AFDW
NET DAILY METABOLISM	Rep 1	-.000
	Rep 2	002
	Rep 3	......
	mean	.001
	se	......
	cv (%)	......

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.941
	Rep 2	1.284
	Rep 3	......
	mean	1.112
	se	.172
	cv (%)	21.816

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
04 September 1973 (light), 05 September 1973 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	130.70	.002	.020	.600
	Rep 2	198.90	.001	.016	.492
	mean	164.80	.001	.018	.546
	se	34.100	.000	.002	.054
	cv (%)	29.262	13.959	13.959	13.959

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	130.70	.001	.021	.622
	Rep 2	198.90	.001	.013	.386
	mean	164.80	.001	.017	.504
	se	34.100	.000	.004	.118
	cv (%)	29.262	33.121	33.121	33.121

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	130.70	.002	.031	.938
	Rep 2	198.90	.002	.023	.702
	mean	164.80	.002	.027	.820
	se	34.100	.000	.004	.118
	cv (%)	29.262	20.361	20.361	20.361

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.011	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.506
	Rep 2	.011		Rep 2	1.816
	mean	.011		mean	1.661
	se	.000		se	.155
	cv (%)	.000		cv (%)	13.207

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
04 October 1973 (light), 03 October 1973 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	227.60	.001	.006	.182
	Rep 2	219.90	.001	.007	.202
	mean	223.75	.001	.006	.192
	se	3.851	.000	.000	.010
	cv (%)	2.434	7.420	7.420	7.420

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	227.60	.000	.005	.167
	Rep 2	219.90	.000	.006	.200
	mean	223.75	.000	.006	.184
	se	3.851	.000	.001	.016
	cv (%)	2.434	12.665	12.665	12.666

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	227.60	.001	.008	.263
	Rep 2	219.90	.001	.010	.299
	mean	223.75	.001	.009	.281
	se	3.851	.000	.001	.018
	cv (%)	2.434	9.083	9.083	9.083

		g O2/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.003	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.570
	Rep 2	.003		Rep 2	1.492
	mean	.003		mean	1.531
	se	.000		se	.039
	cv (%)	2.292		cv (%)	3.603

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
12 November 1973 (light), 13 November 1973 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	334.40	.001	.007	.224
	Rep 2	238.50	.001	.010	.297
	mean	286.45	.001	.009	.261
	se	47.950	.000	.001	.036
	cv (%)	23.673	19.729	19.728	19.728

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	334.40	.000	.006	.169
	Rep 2	238.50	.000	.006	.185
	mean	286.45	.000	.006	.177
	se	47.950	.000	.000	.008
	cv (%)	23.673	6.290	6.290	6.290

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	334.40	.001	.010	.294
	Rep 2	238.50	.001	.012	.373
	mean	286.45	.001	.011	.334
	se	47.950	.000	.001	.040
	cv (%)	23.673	16.786	16.785	16.785

		g 02/da.g AFDW
NET DAILY METABOLISM	Rep 1	.004
	Rep 2	.006
	mean	.005
	se	.001
	cv (%)	28.613

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.741
	Rep 2	2.021
	mean	1.881
	se	.140
	cv (%)	10.552

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 18 December 1973 (light), 19 December 1973 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	341.90	.000	.004	.114
	Rep 2	253.50	.000	.003	.084
	mean	297.70	.000	.003	.099
	se	44.200	.000	.000	.015
	cv (%)	20.997	21.405	21.405	21.405

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	341.90	.000	.003	.079
	Rep 2	253.50	.000	.002	.072
	mean	297.70	.000	.002	.076
	se	44.200	.000	.000	.004
	cv (%)	20.997	7.028	7.029	7.029

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	341.90	.001	.005	.145
	Rep 2	253.50	.000	.004	.112
	mean	297.70	.000	.004	.128
	se	44.200	.000	.001	.016
	cv (%)	20.997	18.185	18.185	18.185

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.002	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.820
	Rep 2	.001		Rep 2	1.552
	mean	.002		mean	1.686
	se	.000		se	.134
	cv (%)	34.293		cv (%)	11.226

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
31 January 1974 (light), 01 February 1974 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	219.10	.000	.003	.081
	Rep 2	379.90	.000	.001	.022
	mean	299.50	.000	.002	.051
	se	80.400	.000	.001	.030
	cv (%)	37.964	81.852	81.852	81.852

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	219.10	.000	.002	.071
	Rep 2	379.90	.000	.002	.054
	mean	299.50	.000	.002	.063
	se	80.400	.000	.000	.009
	cv (%)	37.964	19.720	19.720	19.720

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	219.10	.000	.004	.111
	Rep 2	379.90	.000	.001	.044
	mean	299.50	.000	.002	.077
	se	80.400	.000	.001	.033
	cv (%)	37.964	60.975	60.975	60.975

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.001	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.553
	Rep 2	-.000		Rep 2	.817
	mean	.000		mean	1.185
	se	.001		se	.368
	cv (%)	235.53		cv (%)	43.898

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 20 March 1974 (light), 21 March 1974 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	223.10	.001	.010	.298
	Rep 2	497.70	.000	.003	.106
	mean	360.40	.001	.007	.202
	se	137.30	.000	.003	.096
	cv (%)	53.877	67.029	67.029	67.029

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	223.10	.000	.008	.245
	Rep 2	497.70	.000	.003	.080
	mean	360.40	.000	.005	.163
	se	137.30	.000	.003	.082
	cv (%)	53.877	71.570	71.570	71.570

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	223.10	.001	.014	.421
	Rep 2	497.70	.000	.005	.147
	mean	360.40	.001	.009	.284
	se	137.30	.000	.004	.137
	cv (%)	53.877	68.342	68.342	68.342

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.006	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.721
	Rep 2	.002		Rep 2	1.829
	mean	.004		mean	1.775
	se	.002		se	.054
	cv (%)	64.024		cv (%)	4.274

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
23 April 1974 (light), 22 April 1974 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	377.30	.000	.006	.169
	Rep 2	265.40	.000	.004	.127
	mean	321.35	.000	.005	.148
	se	55.950	.000	.001	.021
	cv (%)	24.623	20.046	20.046	20.045

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	377.30	.000	.008	.242
	Rep 2	265.40	.001	.014	.411
	mean	321.35	.000	.011	.326
	se	55.950	.000	.003	.085
	cv (%)	24.623	36.669	36.669	36.669

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	377.30	.001	.010	.307
	Rep 2	265.40	.001	.012	.362
	mean	321.35	.001	.011	.334
	se	55.950	.000	.001	.027
	cv (%)	24.623	11.590	11.590	11.590

		g O2/da.g AFDW
NET DAILY METABOLISM	Rep 1	.002
	Rep 2	-.002
	mean	.000
	se	.002
	cv (%)	997.60

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.270
	Rep 2	.880
	mean	1.075
	se	.195
	cv (%)	25.625

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
24 April 1974 (light), 22 April 1974 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	377.30	.001	.009	.275
	Rep 2	265.40	.000	.006	.194
	mean	321.35	.001	.008	.234
	se	55.950	.0[illegible]0	.001	.040
	cv (%)	24.623	24.455	24.455	24.455

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	377.30	.000	.008	.242
	Rep 2	265.40	.001	.014	.411
	mean	321.35	.000	.011	.326
	se	55.950	.000	.003	.085
	cv (%)	24.623	36.669	36.669	36.669

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	377.30	.001	.014	.413
	Rep 2	265.40	.001	.014	.429
	mean	321.35	.001	.014	.421
	se	55.950	.000	.000	.008
	cv (%)	24.623	2.699	2.699	2.699

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.006	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.710
	Rep 2	.001		Rep 2	1.045
	mean	.003		mean	1.378
	se	.003		se	.333
	cv (%)	113.82		cv (%)	34.139

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 29 May 1974 (light), 29 May 1974 (dark), NAGEL SITE, DIEL RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	155.10	.001	.012	.383
	Rep 2	306.40	.001	.008	.263
	mean	230.75	.001	.010	.323
	se	75.650	.000	.002	.060
	cv (%)	46.364	26.243	26.243	26.243

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	155.10	.001	.018	.543
	Rep 2	306.40	.000	.009	.290
	mean	230.75	.001	.013	.417
	se	75.650	.000	.004	.127
	cv (%)	46.364	42.973	42.973	42.973

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	155.10	.002	.023	.723
	Rep 2	306.40	.001	.014	.444
	mean	230.75	.001	.019	.583
	se	75.650	.000	.004	.139
	cv (%)	46.364	33.713	33.713	33.713

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.006	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.329
	Rep 2	.005		Rep 2	1.531
	mean	.005		mean	1.430
	se	.000		se	.101
	cv (%)	10.548		cv (%)	9.986

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
01 July 1974 (light), 01 July 1974 (dark), NAGEL SITE, DIEL RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	283.00	.000	.007	.223
	mean	283.00	.000	.007	.223
	se				
	cv (%)				

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	283.00	.001	.013	.402
	mean	283.00	.001	.013	.402
	se				
	cv (%)				

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	283.00	.001	.015	.478
	mean	283.00	.001	.015	.478
	se				
	cv (%)				

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.002	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.188
	mean	.002		mean	1.188
	se			se	
	cv (%)			cv (%)	

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
05 August 1974 (light), 05 August 1974 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	252.60	.001	.014	.440
	Rep 2	162.90	.001	.014	.444
	Rep 3	290.70	......	......	......
	mean	235.40	.001	.014	.442
	se	37.882	.000	.000	.002
	cv (%)	27.873	.649	.649	.647

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	252.60	.000	.009	.276
	Rep 2	162.90	......	......	......
	Rep 3	290.70	.000	.007	.232
	mean	235.40	.000	.008	.254
	se	37.882	.000	.001	.022
	cv (%)	27.873	12.127	12.127	12.127

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	252.60	.001	.019	.604
	Rep 2	162.90	......	......	......
	Rep 3	290.70	......	......	......
	mean	235.40	.001	.019	.604
	se	37.882			
	cv (%)	27.873			

		g 02/da.g AFDW
NET DAILY METABOLISM	Rep 1	.011
	Rep 2	......
	Rep 3	......
	mean	......
	se	......
	cv (%)	......

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	2.189
	Rep 2	......
	Rep 3	......
	mean	2.189
	se	
	cv (%)	

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
06 November 1974 (light), 07 November 1974 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	312.30	.000	.004	.118
	Rep 2	482.30	.000	.004	.124
	Rep 3	370.10	.000	.002	.068
	mean	388.23	.000	.003	.103
	se	49.905	.000	.001	.018
	cv (%)	22.265	29.404	29.404	29.404

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	312.30	.000	.002	.071
	Rep 2	482.30	.000	.003	.098
	Rep 3	370.10	.000	.002	.053
	mean	388.23	.000	.002	.074
	se	49.905	.000	.000	.013
	cv (%)	22.265	29.996	29.996	29.996

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	312.30	.000	.005	.148
	Rep 2	482.30	.001	.006	.165
	Rep 3	370.10	.000	.003	.091
	mean	388.23	.000	.004	.135
	se	49.905	.000	.001	.022
	cv (%)	22.265	28.800	28.800	28.800

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.003	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	2.068
	Rep 2	.002		Rep 2	1.688
	Rep 3	.001		Rep 3	1.701
	mean	.002		mean	1.819
	se	.000		se	.125
	cv (%)	33.681		cv (%)	11.868

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
30 January 1975 (light), 31 January 1975 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	384.00	.000	.001	.017
	Rep 2	408.80	.000	.001	.024
	Rep 3	387.20	.000	.001	.022
	mean	393.33	.000	.001	.021
	se	7.789	.000	.000	.002
	cv (%)	3.430	16.855	16.855	16.855

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	384.00	.000	.002	.060
	Rep 2	408.80	.000	.001	.042
	Rep 3	387.20	.000	.002	.047
	mean	393.33	.000	.002	.050
	se	7.789	.000	.000	.005
	cv (%)	3.430	18.972	18.972	18.973

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	384.00	.000	.001	.042
	Rep 2	408.80	.000	.001	.041
	Rep 3	387.20	.000	.001	.042
	mean	393.33	.000	.001	.042
	se	7.789	.000	.000	.000
	cv (%)	3.430	.890	.890	.889

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	-.001	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	.697
	Rep 2	-.000		Rep 2	.982
	Rep 3	-.000		Rep 3	.888
	mean	-.000		mean	.856
	se	.000		se	.084
	cv (%)	112.35		cv (%)	16.946

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
06 May 1975 (light), 07 May 1975 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	212.90	.000	.005	.150
	Rep 2	332.70	.000	.002	.055
	Rep 3	431.20	.000	.004	.133
	mean	325.60	.000	.004	.113
	se	63.118	.000	.001	.029
	cv (%)	33.576	45.084	45.084	45.084

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	212.90	.000	.005	.144
	Rep 2	332.70	.000	.002	.056
	Rep 3	431.20	.000	.004	.117
	mean	325.60	.000	.003	.106
	se	63.118	.000	.001	.026
	cv (%)	33.576	42.626	42.626	42.626

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	212.90	.001	.008	.236
	Rep 2	332.70	.000	.003	.088
	Rep 3	431.20	.000	.007	.203
	mean	325.60	.000	.006	.176
	se	63.118	.000	.001	.045
	cv (%)	33.576	44.119	44.119	44.119

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.003	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.641
	Rep 2	.001		Rep 2	1.577
	Rep 3	.003		Rep 3	1.734
	mean	.002		mean	1.651
	se	.001		se	.046
	cv (%)	46.942		cv (%)	4.782

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
24 July 1975 (light), 25 July 1975 (dark), NAGEL SITE, STANDARD RUN

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	193.90	.001	.008	.257
	Rep 2	288.80	.000	.003	.081
	Rep 3	313.50	.000	.005	.154
	mean	265.40	.000	.005	.164
	se	36.454	.000	.002	.051
	cv (%)	23.791	53.690	53.690	53.690

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	193.90	.001	.016	.498
	Rep 2	288.80	.000	.009	.292
	Rep 3	313.50	.000	.007	.232
	mean	265.40	.000	.011	.341
	se	36.454	.000	.003	.081
	cv (%)	23.791	41.006	41.006	41.006

		g AFDW DETRITUS/m2	g O2/hr.g AFDW	g O2/da.g AFDW	g O2/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	193.90	.001	.018	.562
	Rep 2	288.80	.001	.008	.261
	Rep 3	313.50	.001	.010	.296
	mean	265.40	.001	.012	.373
	se	36.454	.000	.003	.095
	cv (%)	23.791	44.197	44.197	44.198

		g O2/da.g AFDW
NET DAILY METABOLISM	Rep 1	.002
	Rep 2	-.001
	Rep 3	.002
	mean	.001
	se	.001
	cv (%)	170.38

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.129
	Rep 2	.893
	Rep 3	1.278
	mean	1.100
	se	.112
	cv (%)	17.690

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
26 November 1974 (light), 27 November 1974 (dark), KELLOGG FOREST, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	120.80	.001	.005	.143
	Rep 2	270.10	.000	.005	.140
	Rep 3	253.50	.000	.002	.051
	mean	214.80	.000	.004	.111
	se	47.244	.000	.001	.030
	cv (%)	38.095	47.006	47.006	47.006

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	120.80	.000	.004	.117
	Rep 2	270.10	.000	.002	.068
	Rep 3	253.50	.000	.001	.030
	mean	214.80	.000	.002	.071
	se	47.244	.000	.001	.025
	cv (%)	38.095	61.049	61.049	61.049

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	120.80	.001	.006	.189
	Rep 2	270.10	.001	.006	.166
	Rep 3	253.50	.000	.002	.063
	mean	214.80	.000	.005	.139
	se	47.244	.000	.001	.039
	cv (%)	38.095	48.383	48.383	48.383

		g 02/da.g AFDW
NET DAILY METABOLISM	Rep 1	.002
	Rep 2	.003
	Rep 3	.001
	mean	.002
	se	.001
	cv (%)	48.746

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.619
	Rep 2	2.456
	Rep 3	2.100
	mean	2.058
	se	.242
	cv (%)	20.392

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
06 February 1975 (light), 05 February 1975 (dark), KELLOGG FOREST, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	......	......	......	......
	Rep 2	178.60	.000	.002	.054
	Rep 3	395.40	.000	.001	.030
	mean	287.00	.000	.002	.042
	se	108.40	.000	.000	.012
	cv (%)	53.40	40.242	40.243	40.243

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	.000	......	......	......
	Rep 2	178.60	.000	.002	.053
	Rep 3	395.40	.000	.001	.022
	mean	191.33	.000	.001	.038
	se	114.32	.000	.001	.015
	cv (%)	103.49	57.363	57.363	57.363

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	.000	......	......	......
	Rep 2	178.60	.000	.003	.077
	Rep 3	395.40	.000	.001	.040
	mean	191.33	.000	.002	.058
	se	114.32	.000	.001	.019
	cv (%)	103.49	44.958	44.958	44.958

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	......	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	......
	Rep 2	.001		Rep 2	1.447
	Rep 3	.001		Rep 3	1.771
	mean	.001		mean	1.609
	se	.000		se	.162
	cv (%)	.000		cv (%)	14.241

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan.
13 May 1975 (light), 14 May 1975 (dark), KELLOGG FOREST, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	335.80	.000	.004	.117
	Rep 2	379.60	.000	.004	.127
	Rep 3	351.00	.000	.003	.098
	mean	355.47	.000	.004	.114
	se	12.839	.000	.000	.008
	cv (%)	6.256	12.724	12.724	12.724

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	335.80	.000	.003	.105
	Rep 2	379.60	.000	.002	.072
	Rep 3	351.00	.000	.001	.043
	mean	355.47	.000	.002	.073
	se	12.839	.000	.001	.018
	cv (%)	6.256	42.191	42.191	42.191

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	335.80	.000	.006	.180
	Rep 2	379.60	.000	.006	.171
	Rep 3	351.00	.000	.004	.124
	mean	355.47	.000	.005	.158
	se	12.839	.000	.001	.017
	cv (%)	6.256	18.821	18.821	18.821

		g 02/da.g AFDW
NET DAILY METABOLISM	Rep 1	.002
	Rep 2	.003
	Rep 3	.003
	mean	.003
	se	.000
	cv (%)	14.168

		PG/R24
GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.719
	Rep 2	2.371
	Rep 3	2.891
	mean	2.327
	se	.339
	cv (%)	25.232

Table A-2 (con't). Estimates of Community Metabolism/g AFDW Detritus, Augusta Creek, Michigan. 28 July 1975 (light), 29 July 1975 (dark), KELLOGG FOREST, STANDARD RUN

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
NET COMMUNITY PRODUCTIVITY	Rep 1	246.30	.000	.005	.145
	Rep 2	293.10	.000	.006	.179
	Rep 3	278.40	.000	.004	.118
	mean	272.60	.000	.005	.147
	se	13.818	.000	.001	.018
	cv (%)	8.780	20.669	20.669	20.669

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
COMMUNITY RESPIRATION	Rep 1	246.30	.000	.007	.232
	Rep 2	293.10	.000	.002	.070
	Rep 3	278.40	.000	.006	.194
	mean	272.60	.000	.005	.165
	se	13.818	.000	.002	.049
	cv (%)	8.780	51.327	51.327	51.327

		g AFDW DETRITUS/m2	g 02/hr.g AFDW	g 02/da.g AFDW	g 02/mo.g AFDW
GROSS COMMUNITY PRODUCTIVITY	Rep 1	246.30	.001	.009	.286
	Rep 2	293.10	.000	.007	.222
	Rep 3	278.40	.001	.008	.236
	mean	272.60	.001	.008	.248
	se	13.818	.000	.001	.019
	cv (%)	8.780	13.604	13.604	13.604

		g 02/da.g AFDW			PG/R24
NET DAILY METABOLISM	Rep 1	.002	GROSS COMMUNITY PRODUCTION/ 24 HR RESPIRATION	Rep 1	1.233
	Rep 2	.005		Rep 2	3.174
	Rep 3	.001		Rep 3	1.219
	mean	.003		mean	1.875
	se	.001		se	.650
	cv (%)	72.614		cv (%)	59.989

APPENDIX B

Table B-1. Summary of community metabolism estimates for SMITH SITE, Augusta Creek, Michigan.

DATES		(g 02/m2.hr) NCP	CR	GCP	(g 02/m2.da) NCP	CR	GCP	NDM	PG/R24
24 Oct. 1974 (light)	mean	-.023	.035	.012	-.250	.846	.127	-.719	.153
25 Oct. 1974 (dark)	se	.005	.002	.004	.055	.048	.044	.075	.053
	cv (%)	38.300	9.870	60.400	38.300	9.870	60.400	18.178	60.068
15 Jan. 1975 (light)	mean	-.007	.017	.010	-.066	.402	.092	-.310	.219
16 Jan. 1975 (dark)	se	.000	.003	.003	.004	.065	.025	.040	.032
	cv (%)	9.557	28.160	47.601	9.557	28.160	47.601	22.602	25.656
20 May 1975 (light)	mean	-.007	.019	.012	-.102	.460	.181	-.279	.290
21 May 1975 (dark)	se	.002	.006	.007	.023	.125	.107	.029	.180
	cv (%)	39.875	50.966	102.00	39.875	50.966	102.00	17.930	107.13
17 July 1975 (light)	mean	-.015	.022	.007	-.229	.535	.104	-.431	.191
18 July 1975 (dark)	se	.002	.003	.001	.032	.083	.021	.063	.018
	cv (%)	24.492	26.865	35.635	24.492	26.865	35.636	25.433	15.985

Table B-2. Summary of community metabolism estimates for B AVENUE, Augusta Creek, Michigan.

DATES		NCP (g O2/m2.hr)	CR (g O2/m2.hr)	GCP (g O2/m2.hr)	NCP (g O2/m2.da)	CR (g O2/m2.da)	GCP (g O2/m2.da)	NDM (g O2/m2.da)	PG/R24
26 Jan. 1973 (light)	mean	-.002	.011	.009	-.023	.274	.088	-.186	.322
25 Jan. 1973 (dark)	se								
	cv (%)								
07 June 1973 (light)	mean	.010	.029	.039	.146	.701	.590	-.111	.816
06 June 1973 (dark)	se	.007	.003	.015	.101	.190	.221	.031	.094
	cv (%)	97.456	38.261	52.965	97.456	38.261	52.965	39.797	16.361
07 June 1973 (light)	mean	.010	.028	.038	.146	.668	.569	-.099	.837
07 June 1973 (dark)	se	.007	.003	.010	.101	.078	.150	.072	.127
	cv (%)	97.456	16.503	37.335	97.456	16.503	37.335	103.05	21.497
05 July 1973 (light)	mean	-.012	.030	.018	-.175	.708	.272	-.436	.326
04 July 1973 (dark)	se	.005	.009	.014	.069	.216	.206	.010	.191
	cv (%)	55.711	43.145	106.76	55.711	43.146	106.76	3.376	82.635
02 Aug. 1973 (light)	mean	.006	.031	.037	.082	.746	.531	-.216	.715
01 Aug. 1973 (dark)	se	.000	.006	.006	.000	.146	.088	.058	.022
	cv (%)	.000	27.739	23.442	.000	27.739	23.442	38.313	4.438
29 Aug. 1973 (light)	mean	-.008	.025	.016	-.110	.590	.217	-.373	.382
30 Aug. 1973 (dark)	se	.004	.006	.002	.057	.151	.027	.124	.052
	cv (%)	72.853	36.218	17.732	72.853	36.218	17.732	47.001	19.091
27 Sep. 1973 (light)	mean	-.013	.036	.023	-.149	.858	.278	-.580	.324
26 Sep. 1973 (dark)	se	.001	.003	.002	.018	.083	.023	.059	.004
	cv (%)	16.971	13.648	11.861	16.970	13.648	11.861	14.503	1.788
05 Nov. 1973 (light)	mean	-.005	.014	.010	-.046	.342	.099	-.243	.289
06 Nov. 1973 (dark)	se	.001	.001	.000	.008	.016	.001	.017	.016
	cv (%)	23.311	6.451	1.459	23.311	6.451	1.457	9.680	7.891
11 Dec. 1973 (light)	mean	-.011	.010	-.001	-.102	.240	-.011	-.251	-.017
12 Dec. 1973 (dark)	se	.008	.001	.007	.070	.026	.060	.086	.248
	cv (%)	97.029	15.556	805.49	97.029	15.556	805.49	48.740	2111.9
23 Jan. 1974 (light)	mean	.000	.012	.012	.001	.278	.113	-.165	.407
22 Jan. 1974 (dark)	se	.000	.001	.001	.001	.019	.007	.012	.004
	cv (%)	141.42	9.733	8.461	141.42	9.753	8.461	10.661	1.303

Table B-2 (con't). Summary of community metabolism estimates for B AVENUE, Augusta Creek, Michigan.

DATES		(g 02/m2.hr) NCP	CR	GCP	(g 02/m2.da) NCP	CR	GCP	NDM	PG/R24
05 Mar. 1974 (light)	mean	-.001	.011	.007	-.012	.266	.075	-.002	.283
04 Mar. 1974 (dark)	se	.003			.039				
	cv (%)	464.67			464.67				
09 Apr. 1974 (light)	mean	-.009	.026	.017	-.114	.616	.222	-.394	.362
10 Apr. 1974 (dark)	se	.003	.001	.002	.035	.023	.023	.046	.051
	cv (%)	43.889	5.238	14.601	43.889	5.238	14.601	16.407	19.768
15 May 1974 (light)	mean	.008	.021	.029	.115	.504	.421	-.083	.881
16 May 1974 (dark)	se	.007	.004	.003	.097	.094	.040	.134	.243
	cv (%)	119.80	26.264	13.430	119.80	26.264	13.430	228.58	39.050
17 Oct. 1974 (light)	mean	-.002	.022	.020	-.019	.529	.223	-.305	.421
18 Oct. 1974 (dark)	se	.003	.001	.004	.038	.024	.042	.038	.076
	cv (%)	342.32	7.995	32.597	342.32	7.995	32.597	21.700	31.147
09 Jan. 1975 (light)	mean	-.002	.010	.008	-.019	.236	.072	-.164	.306
08 Jan. 1975 (dark)	se	.001	.003	.002	.008	.076	.022	.054	.017
	cv (%)	75.285	55.443	53.724	75.285	55.443	53.724	56.763	9.704
16 Apr. 1975 (light)	mean	.008	.025	.033	.106	.592	.437	-.155	.725
17 Apr. 1975 (dark)	se	.005	.003	.007	.072	.065	.100	.056	.115
	cv (%)	116.52	19.086	39.767	116.52	19.086	39.767	61.969	27.531
14 July 1975 (light)	mean	-.000	.039	.038	-.002	.924	.576	-.349	.623
15 July 1975 (dark)	se	.001	.001	.001	.009	.025	.011	.017	.010
	cv (%)	808.93	4.595	3.361	808.93	4.595	3.362	8.465	2.868

Table B-3. Summary of community metabolism estimates for UPPER 43, Augusta Creek, Michigan.

DATES		(g 02/m2.hr) NCP	CR	GCP	(g 02/m2.da) NCP	CR	GCP	NDM	PG/R24
30 Oct. 1974 (light)	mean	.151	.099	.250	1.570	2.384	2.606	.222	1.092
31 Oct. 1974 (dark)	se	.036	.000	.037	.377	.011	.382	.371	.155
	cv (%)	33.958	.641	20.712	33.958	.640	20.712	236.25	20.085
21 Jan. 1975 (light)	mean	.020	.016	.036	.190	.386	.344	-.042	.912
22 Jan. 1975 (dark)	se	.005	.004	.009	.048	.097	.083	.032	.074
	cv (%)	43.358	43.314	41.544	43.358	43.314	41.544	130.87	14.071
27 May 1975 (light)	mean	.138	.079	.217	2.064	1.904	3.250	1.346	1.683
28 May 1975 (dark)	se	.046	.006	.050	.686	.140	.751	.650	.290
	cv (%)	57.615	12.741	40.008	57.615	12.741	40.008	83.693	29.822
21 July 1975 (light)	mean	.077	.104	.171	1.145	2.502	2.528	.288	1.112
22 July 1975 (dark)	se	.033	.012	.042	.488	.289	.618	.408	.172
	cv (%)	60.321	19.982	34.568	60.321	19.982	34.568	200.42	21.816

Table B-4. Summary of community metabolism estimates for NAGEL SITE, Augusta Creek, Michigan.

DATES		(g 02/m2.hr)			(g 02/m2.da)				
		NCP	CR	GCP	NCP	CR	GCP	NDM	PG/R24
08 Aug. 1973 (light)	mean	.284	.093	.377	4.027	2.242	5.353	3.112	2.586
09 Aug. 1973 (dark)	se	.067	.021	.046	.950	.506	.650	1.157	.874
	cv (%)	33.361	31.948	17.180	33.361	31.949	17.181	52.573	47.819
04 Sep. 1973 (light)	mean	.225	.110	.335	2.937	2.636	4.368	1.732	1.661
05 Sep. 1973 (dark)	se	.025	.003	.022	.324	.076	.283	.359	.155
	cv (%)	15.623	4.035	9.175	15.623	4.055	9.175	29.315	13.207
04 Oct. 1973 (light)	mean	.119	.055	.174	1.383	1.325	2.024	.699	1.531
03 Oct. 1973 (dark)	se	.004	.004	.008	.049	.096	.095	.001	.039
	cv (%)	4.991	10.248	6.657	4.991	10.248	6.657	.148	3.603
12 Nov. 1973 (light)	mean	.245	.070	.315	2.431	1.676	3.124	1.448	1.881
13 Nov. 1973 (dark)	se	.007	.009	.016	.069	.208	.155	.052	.140
	cv (%)	4.039	17.513	7.027	4.039	17.513	7.027	5.113	10.552
18 Dec. 1973 (light)	mean	.107	.031	.138	.976	.732	1.254	.521	1.686
19 Dec. 1973 (dark)	se	.031	.006	.037	.286	.144	.341	.197	.134
	cv (%)	41.470	27.821	38.448	41.470	27.820	38.448	53.369	11.226
31 Jan. 1974 (light)	mean	.042	.024	.066	.419	.532	.661	.079	1.185
01 Feb. 1974 (dark)	se	.015	.003	.012	.154	.078	.122	.200	.368
	cv (%)	51.961	18.953	26.023	51.961	18.953	26.023	357.31	43.898
20 Mar. 1974 (light)	mean	.159	.064	.222	1.924	1.525	2.695	1.170	1.775
21 Mar. 1974 (dark)	se	.018	.019	.028	.218	.236	.338	.101	.054
	cv (%)	16.050	21.920	17.729	16.050	21.920	17.729	12.262	4.274
23 Apr. 1974 (light)	mean	.118	.139	.257	1.622	3.336	3.529	.193	1.075
22 Apr. 1974 (dark)	se	.036	.012	.024	.500	.298	.330	.628	.195
	cv (%)	43.592	12.616	13.221	43.592	12.616	13.221	458.77	25.625
24 Apr. 1974 (light)	mean	.183	.139	.327	2.583	3.336	4.497	1.161	1.378
22 Apr. 1974 (dark)	se	.063	.012	.051	.870	.298	.700	.997	.333
	cv (%)	47.643	12.616	21.997	47.643	12.616	21.997	121.43	34.139
29 May 1974 (light)	mean	.150	.116	.267	2.258	2.794	4.003	1.210	1.430
29 May 1974 (dark)	se	.023	.093	.026	.342	.074	.339	.314	.101
	cv (%)	21.425	3.766	13.724	21.425	3.767	13.724	36.714	9.986

Table B-4 (con't). Summary of community metabolism estimates for NAGEL SITE, Augusta Creek, Michigan.

DATES		(g 02/m2.hr) NCP	CR	GCP	(g 02/m2.da) NCP	CR	GCP	NDM	PG/R24
01 July 1974 (light)	mean	.133	.153	.286	2.032	3.672	4.362	.690	1.188
01 July 1974 (dark)	se								
	cv (%)								
05 Aug. 1974 (light)	mean	.207	.092	.344	2.958	2.214	4.923	.011	2.189
05 Aug. 1974 (dark)	se	.044	.001		.626	.035			
	cv (%)	29.911	2.224		29.911	2.223			
06 Nov. 1974 (light)	mean	.134	.041	.175	1.553	.992	1.772	.780	1.819
07 Nov. 1974 (dark)	se	.033	.012	.045	.337	.291	.457	.179	.125
	cv (%)	43.164	50.811	44.700	43.164	50.811	44.700	39.773	11.868
30 Jan. 1975 (light)	mean	.027	.026	.053	.268	.629	.528	-.101	.856
31 Jan. 1975 (dark)	se	.003	.002	.001	.030	.059	.008	.065	.084
	cv (%)	19.525	16.385	2.605	19.524	16.385	2.604	111.58	16.946
06 May 1975 (light)	mean	.081	.045	.126	1.159	1.071	1.796	.724	1.651
07 May 1975 (dark)	se	.026	.012	.038	.371	.300	.549	.249	.046
	cv (%)	55.378	48.434	52.913	55.378	48.434	52.913	59.568	4.782
06 May 1975 (light)	mean	-.017	.096	-.012	-.249	.134	-.170	-.304	-1.262
07 May 1975 (dark)	se								
	cv (%)								
24 July 1975 (light)	mean	.089	.114	.202	1.307	2.726	2.980	.254	1.100
25 July 1975 (dark)	se	.019	.009	.021	.275	.223	.314	.283	.112
	cv (%)	36.387	14.173	18.267	36.387	14.173	18.266	192.76	17.690

Table B-5. Summary of community metabolism estimates for KELLOGG FOREST, Augusta Creek, Michigan.

DATES		(g 02/m2.hr) NCP	CR	GCP	(g 02/m2.da) NCP	CR	GCP	NDM	PG/R24
26 Nov. 1974 (light)	mean	.080	.019	.098	.754	.444	.929	.485	2.058
27 Nov. 1974 (dark)	se	.027	.004	.031	.255	.104	.292	.201	.242
	cv (%)	58.436	40.598	54.360	58.486	40.598	54.360	71.763	20.392
06 Feb. 1975 (light)	mean	.038	.013	.032	.386	.319	.525	.001	1.609
05 Feb. 1975 (dark)	se	.004	.000	.003	.040	.010	.036		.162
	cv (%)	14.759	5.676	9.611	14.759	5.677	9.611		14.241
13 May 1975 (light)	mean	.090	.035	.125	1.311	.834	1.816	.982	2.327
14 May 1975 (dark)	se	.009	.008	.014	.130	.188	.208	.117	.339
	cv (%)	17.110	39.128	19.795	17.110	39.128	19.795	20.612	25.232
28 July 1975 (light)	mean	.089	.059	.148	1.302	1.414	2.163	.748	1.875
29 July 1975 (dark)	se	.014	.016	.004	.197	.378	.055	.344	.650
	cv (%)	26.236	46.335	4.407	26.236	46.335	4.407	79.533	59.989

Table B - 6. Summary of community metabolism estimates on a detrital AFDW basis for Smith Site, Augusta Creek, Michigan.

Dates		AFDW G/M^{-2}	NCP $GO_2/G^{-1}D^{-1}$	CR $GO_2/G^{-1}D^{-1}$	GCP $GO_2/G^{-1}D^{-1}$	NDM $GO_2/G^{-1}D^{-1}$
24 Oct. 1974 (light)	mean	479.83	- 0.001	0.002	0.000	- 0.002
25 Oct. 1974 (dark)	S.E.	94.38	0.000	0.001	....	0.001
	C.V. %	34.07	81.13	49.73	....	61.17
15 Jan. 1975 (light)	mean	439.87	0.000	0.001	0.000	- 0.001
16 Jan. 1975 (dark)	S.E.	40.68	.....	0.000	.....	0.000
	C.V.%	16.01	.....	39.83	.....	34.62
20 May 1975 (light)	mean	253.34	- 0.001	0.003	0.001	- 0.002
21 May 1975 (dark)	S.E.	98.10	0.000	0.002	0.001	0.001
	C.V.%	67.07	80.97	96.04	116.40	86.98
17 July 1975 (light)	mean	379.80	- 0.001	0.001	0.000	- 0.001
18 July 1975 (dark)	S.E.	62.20	0.000	0.000	.....	0.000
	C.V.%	28.36	4.76	10.48	.....	7.085

Table B - 7. Summary of community metabolism estimates on a detrital AFDW basis for B Avenue Site Augusta Creek, Michigan.

Dates		AFDW G/M^{-2}	NCP $GO_2/G^{-1}D^{-1}$	CR $GO_2/G^{-1}D^{-1}$	GCP $GO_2/G^{-1}D^{-1}$	NDM $GO_2/G^{-1}D^{-1}$
02 Aug. 1973 (light)	mean	248.60	0.000	0.003	0.002	- 0.001
01 Aug. 1973 (dark)	S.E.	5.00	.....	0.001	0.000	0.000
	C.V.%	2.84	.....	30.46	26.20	40.94
29 Aug. 1973 (light)	mean	265.40	0.000	0.002	0.001	- 0.001
30 Aug. 1973 (dark)	S.E.	4.60	.....	0.001	0.000	0.000
	C.V.%	2.45	.....	33.92	15.31	44.81
27 Sept. 1973(light)	mean	215.37	-0.001	0.006	0.002	- 0.004
26 Sept. 1973(dark)	S.E.	116.12	-0.001	0.004	0.001	0.002
	C.V.%	76.25	87.56	85.45	84.30	86.00
05 Nov. 1973 (light)	mean	192.10	0.000	0.002	0.001	- 0.001
06 Nov. 1973 (dark)	S.E.	52.10	.....	0.001	0.000	0.000
	C.V.%	38.36	.....	44.26	37.00	47.16
11 Dec. 1973 (light)	mean	248.80	0.000	0.001	0.000	- 0.001
12 Dec. 1973 (dark)	S.E.	55.60	.....	0.000	.....	0.001
	C.V.%	31.60	.....	46.03	.....	74.60
23 Jan. 1974 (light)	mean	242.60	0.000	0.001	0.000	- 0.001
22 Jan. 1974 (dark)	S.E.	25.10	.....	0.000	.....	0.000
	C.V.%	14.63	.....	4.91	.....	4.00
05 Mar. 1974 (light)	mean	215.70	0.000	0.002	0.001	- 0.002
04 Mar. 1974 (dark)	S.E.	100.70	.....	.....	.....	.....
	C.V.%	66.02	.....	.....	.....	.....

Table B - 7 (cont.).

Dates		AFDW G/M^{-2}	NCP $GO_2/G^{-1}D^{-1}$	CR $GO_2/G^{-1}D^{-1}$	GCP $GO_2/G^{-1}D^{-1}$	NDM $GO_2/G^{-1}D^{-1}$
09 April 1974(light)	mean	320.30	0.000	0.002	0.001	- 0.001
10 April 1974(dark)	S.E.	92.00	.....	0.001	0.000	0.000
	C.V.%	40.62	.....	35.76	53.63	25.05
15 May 1974 (light)	mean	276.80	0.000	0.002	0.002	0.000
16 May 1974 (dark)	S.E.	46.00	.....	0.000	0.000	.....
	C.V.%	23.50	.....	2.85	36.41	.....
17 Oct. 1974(light)	mean	592.00	0.000	0.001	0.000	- 0.001
18 Oct. 1974(dark)	S.E.	39.90	.....	0.000	.....	0.000
	C.V.%	11.67	.....	20.28	.....	30.34
09 Jan. 1975 (light)	mean	176.98	0.000	0.002	0.001	- 0.001
08 Jan. 1975 (dark)	S.E.	54.15	.....	0.001	.....	0.001
	C.V.%	53.00	.....	104.38	99.88	106.34
16 April 1975(light)	mean	144.97	0.001	0.004	0.003	- 0.001
17 April 1975(dark)	S.E.	19.96	0.001	0.001	0.001	0.001
	C.V.%	23.85	133.42	29.10	40.49	79.82
14 July 1975 (light)	mean	330.2	0.000	0.003	0.002	- 0.001
15 July 1975 (dark)	S.E.	41.12	.....	0.000	0.000	0.000
	C.V.%	21.57	.....	20.86	23.94	15.71

Table B - 8. Summary of community metabolism estimates on a detrital AFDW basis for Upper 43RD Site Augusta Creek, Michigan.

Dates		AFDW G/M^{-2}	NCP $GO_2/G^{-1}D^{-1}$	CR $GO_2/G^{-1}D^{-1}$	GCP $GO_2/G^{-1}D^{-1}$	NDM $GO_2/G^{-1}D^{-1}$
30 Oct. 1974 (light)	mean	218.35	0.008	0.011	0.013	0.001
31 Oct. 1974 (dark)	S.E.	44.75	0.003	0.002	0.004	0.002
	C.V.%	28.98	59.99	29.59	48.25	197.59
21 Jan. 1975 (light)	mean	235.03	0.001	0.002	0.001	0.000
22 Jan. 1975 (dark)	S.E.	35.48	0.000	0.000	0.000	......
	C.V.%	26.15	16.97	29.09	19.05	......
27 May 1975 (light)	mean	179.10	0.011	0.011	0.018	0.007
28 May 1975 (dark)	S.E.	2.53	0.004	0.001	0.004	0.004
	C.V.%	2.45	55.90	12.54	38.18	82.46
21 July 1975(light)	mean	328.03	0.003	0.008	0.007	0.001
22 July 1975(dark)	S.E.	34.91	0.001	0.002	0.001	.....
	C.V.%	18.44	55.54	39.57	29.11	.....

Table B - 9. Summary of community metabolism estimates on a detrital AFDW basis for Nagle Site Augusta Creek, Michigan.

Dates		AFDW G/M^{-2}	NCP $GO_2/G^{-1}D^{-1}$	CR $GO_2/G^{-1}D^{-1}$	GCP $GO_2/G^{-1}D^{-1}$	NDM $GO_2/G^{-1}D^{-1}$
04 Sept. 1973(light)	mean	164.80	0.018	0.017	0.027	0.011
05 Sept. 1973(dark)	S.E.	34.10	0.002	0.004	0.004	0.000
	C.V.%	29.26	13.96	33.12	20.36	0.00
04 Oct. 1973 (light)	mean	223.75	0.006	0.006	0.009	0.003
03 Oct. 1973 (dark)	S.E.	3.85	0.000	0.001	0.001	0.000
	C.V.%	2.43	7.42	12.67	9.08	2.29
12 Nov. 1973 (light)	mean	286.45	0.009	0.006	0.011	0.005
13 Nov. 1973 (dark)	S.E.	47.95	0.001	0.000	0.001	0.000
	C.V.%	23.67	19.73	6.29	16.79	28.61
18 Dec. 1973 (light)	mean	297.70	0.003	0.002	0.004	0.002
19 Dec. 1973 (dark)	S.E.	44.20	0.000	0.000	0.001	0.000
	C.V.%	21.00	21.41	7.03	18.19	34.29
31 Jan. 1974 (light)	mean	299.50	0.002	0.002	0.002	0.000
01 Feb. 1974 (dark)	S.E.	80.40	0.001	0.000	0.001	0.001
	C.V.%	37.96	81.85	19.72	60.98	235.53
20 March 1974(light)	mean	360.40	0.007	0.005	0.009	0.004
21 March 1974(dark)	S.E.	137.30	0.003	0.003	0.004	0.002
	C.V.%	53.88	67.03	71.57	68.34	64.02
23 April 1974(light)	mean	321.35	0.005	0.011	0.011	0.000
22 April 1974(dark)	S.E.	55.95	0.001	0.003	0.001	.....
	C.V.%	24.62	20.05	36.67	11.59	.....

Table B - 9 (cont.).

Dates		AFDW G/M^{-2}	NCP $GO_2/G^{-1}D^{-1}$	CR $GO_2/G^{-1}D^{-1}$	GCP $GO_2/G^{-1}D^{-1}$	NDM $GO_2/G^{-1}D^{-1}$
24 April 1974(light)	mean	321.35	0.008	0.011	0.014	0.003
22 April 1974(dark)	S.E.	55.95	0.001	0.003	0.000	0.003
	C.V.%	24.62	24.46	36.67	2.70	113.82
29 May 1974 (light)	mean	230.75	0.010	0.013	0.019	0.005
29 May 1974 (dark)	S.E.	75.65	0.002	0.004	0.004	0.000
	C.V.%	46.36	26.24	42.97	33.71	10.55
01 July 1974(light) (dark)	mean	283.00	0.007	0.013	0.015	0.002
05 Aug. 1974(light)	mean	235.40	0.014	0.008	0.019	0.011
05 Aug. 1974(dark)	S.E.	37.88	0.000	0.001	.....	.....
	C.V.%	27.87	0.649	12.127	.....	.....
06 Nov. 1974 (light)	mean	388.23	0.003	0.002	0.004	0.002
07 Nov. 1974 (dark)	S.E.	49.91	0.001	0.000	0.001	0.000
	C.V.%	22.27	29.40	30.00	28.80	33.68
30 Jan.1975 (light)	mean	393.33	0.001	0.002	0.001	0.000
31 Jan.1975 (dark)	S.E.	7.79	0.000	0.000	0.000	.....
	C.V.%	3.43	16.86	18.97	0.89	.....
06 May 1975 (light)	mean	325.60	0.004	0.003	0.006	0.002
07 May 1975 (dark)	S.E.	63.12	0.001	0.001	0.001	0.001
	C.V.%	33.58	45.08	42.63	44.12	46.94
24 July 1975(light)	mean	265.40	0.005	0.011	0.012	0.001
25 July 1975(dark)	S.E.	36.45	0.002	0.003	0.003	0.001
	C.V.%	23.79	53.69	41.00	44.20	170.38

Table B - 10. Summary of community metabolism estimates on a detrital AFDW basis for Kellogg Forest Site Augusta Creek, Michigan.

Date		AFDW G/M^{-2}	NCP $GO_2/G^{-1}D^{-1}$	CR $GO_2/G^{-1}D^{-1}$	GCP $GO_2/G^{-1}D^{-1}$	NDM $GO_2/G^{-1}D^{-1}$
26 Nov. 1974 (light)	mean	214.80	0.004	0.002	0.005	0.002
27 Nov. 1974 (dark)	S.E.	47.24	0.001	0.001	0.001	0.001
	C.V.%	38.10	47.01	61.05	48.38	48.75
06 Feb. 1975 (light)	mean	191.33	0.002	0.001	0.002	0.001
05 Feb. 1975 (dark)	S.E.	114.32	0.000	0.001	0.001	0.000
	C.V.%	103.49	40.24	57.36	44.96	0.000
13 May 1975 (light)	mean	355.47	0.004	0.002	0.005	0.003
14 May 1975 (dark)	S.E.	12.84	0.000	0.001	0.001	0.000
	C.V.%	6.26	12.72	42.19	18.82	14.17
28 July 1975(light)	mean	272.60	0.005	0.005	0.008	0.003
29 July 1975(dark)	S.E.	13.82	0.001	0.002	0.001	0.001
	C.V.%	8.78	20.67	51.32	13.60	72.61

APPENDIX C

Table C-1. Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan.
24 October 1974 (light), 25 October 1974 (dark), SMITH SITE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	561.7	2002.	2563.
	Rep 2	291.6	2725.	3016.
	Rep 3	586.2	1952.	2538.
	mean	479.8	2226.	2706.
	se	94.38	249.7	155.3
	cv (%)	34.06	19.43	9.94

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	2.62	11.77	57.58	198.3	122.4	169.0
	Rep 2	18.34	10.65	24.51	54.41	77.74	105.9
	Rep 3	6.26	20.36	67.02	205.6	80.01	207.0
	mean	9.07	14.26	49.70	152.7	93.38	160.6
	se	4.74	3.06	12.88	49.22	14.52	29.48
	cv (%)	90.62	37.25	44.91	55.81	26.93	31.79

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	722.9	759.0	483.8	30.58	5.56
	Rep 2	.....	.....	.....	.....	.....
	Rep 3	825.7	839.6	222.4	58.39	5.56
	mean	774.3	799.3	353.1	44.48	5.56
	se	51.39	40.29	130.7	13.90	
	cv (%)	9.38	7.13	52.34	44.20	16187

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	725.5	770.7	541.3	228.8	127.9
	Rep 2	.....	.....	.....	.....	.....
	Rep 3	831.9	859.9	289.4	263.9	85.57
	mean	778.7	815.3	415.4	246.4	106.7
	se	53.22	44.59	125.9	17.55	21.19
	cv (%)	9.66	7.73	42.88	10.07	28.07

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 15 January 1975 (light), 16 January 1975 (dark), SMITH SITE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	517.2	1732.	2249.
	Rep 2	423.1	1337.	1760.
	Rep 3	379.3	1868.	2247.
	mean	439.8	1645.	2085.
	se	40.68	159.2	162.7
	cv (%)	16.01	16.76	13.51

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	59.15	86.70	162.1	56.19	153.0
	Rep 2	.00	15.84	50.59	170.5	64.24	121.9
	Rep 3	39.34	25.70	59.66	118.1	29.84	106.6
	mean	13.11	33.56	65.65	150.2	50.09	127.1
	se	13.11	13.10	10.84	16.24	10.38	13.65
	cv (%)	173.2	67.63	28.61	18.73	35.92	18.59

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	989.8	586.6	125.1	27.80	2.78
	Rep 2	422.6	636.7	191.8	75.07	11.12
	Rep 3	.....	.....	.....	.....	.....
	mean	706.2	611.6	158.4	51.43	6.95
	se	283.6	25.04	33.35	23.63	4.17
	cv (%)	56.79	5.79	29.76	64.98	84.85

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	989.8	645.7	211.8	189.9	58.97
	Rep 2	422.6	652.5	242.3	245.5	75.36
	Rep 3	.....	.....	.....	.....	.....
	mean	706.2	649.1	227.1	217.7	67.16
	se	283.6	3.38	15.29	27.88	8.19
	cv (%)	56.79	.78	9.52	18.07	17.25

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan.
20 May 1975 (light), 21 May 1975 (dark), SMITH SITE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	86.63	1170.	1256.
	Rep 2	426.3	1387.	1813.
	Rep 3	247.1	1885.	2132.
	mean	253.3	1480.	1734.
	se	98.10	211.6	255.8
	cv (%)	67.07	24.75	25.55

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....	.....
	Rep 2	.00	47.08	44.04	64.27	93.06	177.8
	Rep 3	.00	5.67	17.67	70.35	54.76	98.63
	mean	.00	26.37	30.85	67.31	73.91	138.2
	se		20.70	13.18	3.04	19.15	39.58
	cv (%)		111.0	60.43	6.38	36.64	40.50

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	380.9	392.2	144.6	52.82	.00
	Rep 2	636.7	425.4	247.4	72.29	5.56
	Rep 3	289.1	1348.	144.6	69.51	33.36
	mean	435.5	788.5	178.8	64.87	12.97
	se	104.0	283.8	34.26	6.08	10.31
	cv (%)	41.35	62.34	33.18	16.23	137.7

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	636.7	472.4	291.4	136.5	98.62
	Rep 3	289.1	1353.	162.2	139.8	88.12
	mean	462.9	913.9	226.8	138.2	93.37
	se	173.8	449.5	64.58	1.64	5.25
	cv (%)	53.09	68.24	40.26	1.68	7.95

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 17 July 1975 (light), 18 July 1975 (dark), SMITH SITE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	497.5	1743.	2240.
	Rep 2	286.1	2002.	2288.
	Rep 3	355.8	1362.	1717.
	mean	379.8	1702.	2082.
	se	62.19	185.8	182.6
	cv (%)	28.36	18.91	15.19

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....	.....
	Rep 2	.00	4.99	15.81	47.70	55.54	162.1
	Rep 3	13.46	27.35	31.12	57.33	87.92	138.6
	mean	6.73	16.17	23.46	52.51	71.73	150.3
	se	6.73	11.17	7.65	4.81	16.19	11.75
	cv (%)	141.4	97.72	46.13	12.96	31.92	11.05

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	525.5	784.0	336.4	91.75	5.56
	Rep 2	586.6	853.5	361.4	180.7	19.46
	Rep 3	172.4	697.8	344.7	136.2	11.12
	mean	428.1	778.4	347.5	136.2	12.04
	se	129.0	45.03	7.35	25.67	4.03
	cv (%)	52.22	10.02	3.66	32.65	58.07

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	586.6	858.5	377.2	228.4	75.00
	Rep 3	185.8	725.1	375.8	193.5	99.04
	mean	386.2	791.8	376.5	210.9	87.02
	se	200.3	66.67	.70	17.43	12.02
	cv (%)	73.36	11.90	.26	11.68	19.53

Table C-1. Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan.
17 October 1974 (light), 18 October 1974 (dark), B AVENUE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	623.9	2049.	2672.
	Rep 2	639.4	2452.	3091.
	Rep 3	512.7	2260.	2772.
	mean	592.0	2253.	2845.
	se	39.90	116.3	126.2
	cv (%)	11.67	8.94	7.68

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	32.16	127.6	165.0	122.6	176.7
	Rep 2	.00	55.00	166.7	103.4	143.5	170.8
	Rep 3	.00	55.09	79.75	126.2	120.4	131.3
	mean	.00	47.41	124.6	131.5	128.8	159.6
	se		7.62	25.14	17.98	7.36	14.25
	cv (%)		27.86	34.92	23.67	9.89	15.46

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	925.8	825.7	180.7	111.2	5.56
	Rep 2	.....	.....	.....	.....	.....
	Rep 3	1251.	786.8	139.0	80.63	2.78
	mean	1088.	806.2	159.8	95.91	4.17
	se	162.6	19.44	20.85	15.28	1.39
	cv (%)	21.12	3.41	18.44	22.53	47.14

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	925.8	857.8	308.3	276.2	128.1
	Rep 2	.....	.....	.....	.....	.....
	Rep 3	1251.	841.8	218.7	206.8	123.1
	mean	1088.	849.8	263.5	241.5	125.6
	se	162.6	7.98	44.77	34.68	2.49
	cv (%)	21.12	1.32	24.02	20.31	2.80

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan.
09 January 1975 (light), 08 January 1975 (dark), B AVENUE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	166.9	1646.	1812.
	Rep 2	88.63	2369.	2457.
	Rep 3	275.4	1910.	2185.
	mean	176.9	1975.	2152.
	se	54.15	211.2	186.8
	cv (%)	52.99	18.52	15.04

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	6.62	15.84	21.88	57.69	64.90
	Rep 2	.00	9.10	12.79	11.07	8.67	46.99
	Rep 3	.00	55.17	28.31	40.39	64.42	87.07
	mean	.00	23.63	18.98	24.44	43.59	66.32
	se		15.78	4.74	8.56	17.56	11.59
	cv (%)		115.7	43.32	60.65	69.80	30.27

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	519.9	861.9	155.7	105.6	2.78
	Rep 2	1082.	422.6	725.6	139.0	.00
	Rep 3	1090.	650.6	114.0	52.82	2.78
	mean	897.3	645.0	331.7	99.14	1.85
	se	188.7	126.8	197.2	25.08	.92
	cv (%)	36.42	34.06	103.0	43.82	86.60

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	519.9	868.5	171.5	127.4	60.47
	Rep 2	1082.	431.7	738.3	150.0	8.67
	Rep 3	1090.	705.7	142.3	93.21	67.20
	mean	897.3	668.6	350.7	123.5	45.44
	se	188.7	127.4	194.0	16.52	18.49
	cv (%)	36.42	33.01	95.80	23.16	70.46

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 16 April 1975 (light), 17 April 1975 (dark), B AVENUE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	135.8	2508.	2643.
	Rep 2	115.9	1777.	1892.
	Rep 3	183.2	2891.	3074.
	mean	144.9	2392.	2537.
	se	19.96	326.7	345.1
	cv (%)	23.84	23.66	23.56

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	15.71	16.48	20.77	33.66	49.14
	Rep 2	.00	4.17	18.62	17.05	15.47	60.62
	Rep 3	.....	.....	.....	.....	.....	.....
	mean	.00	9.94	17.55	18.91	24.56	54.88
	se		5.77	1.07	1.86	9.09	5.74
	cv (%)		82.09	8.62	13.91	52.36	14.79

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	1343.	789.6	211.3	155.7	8.34
	Rep 2	319.7	1079.	272.5	100.1	5.56
	Rep 3	842.4	1429.	347.5	250.2	22.24
	mean	835.0	1099.	277.1	168.6	12.04
	se	295.4	184.8	39.38	43.81	5.15
	cv (%)	61.27	29.12	24.61	44.99	74.17

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	1343.	805.3	227.7	176.4	42.00
	Rep 2	319.7	1033.	291.1	117.1	21.03
	Rep 3	.....	.....	.....	.....	.....
	mean	831.3	944.2	259.4	146.8	31.51
	se	511.6	138.9	31.67	29.66	10.48
	cv (%)	87.03	20.20	17.26	28.57	47.05

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan.
14 July 1975 (light), 15 July 1975 (dark), B AVENUE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	367.2	3322.	3689.
	Rep 2	248.1	2360.	2608.
	Rep 3	375.3	2752.	3127.
	mean	330.2	2811.	3141.
	se	41.11	279.2	312.1
	cv (%)	21.56	17.20	17.21

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....	.....
	Rep 2	.00	19.75	42.51	54.00	60.76	71.08
	Rep 3	.00	30.23	73.56	79.60	101.6	90.31
	mean	.00	24.99	58.03	66.80	81.18	80.69
	se		5.24	15.52	12.80	20.42	9.61
	cv (%)		29.65	37.83	27.09	35.57	16.85

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	1754.	1018.	330.8	216.9	2.78
	Rep 2	1087.	856.3	305.8	108.4	2.78
	Rep 3	1615.	850.8	166.8	105.6	13.90
	mean	1485.	908.3	267.8	143.6	6.48
	se	203.1	54.83	51.01	36.64	3.70
	cv (%)	23.69	10.45	32.99	44.18	98.97

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	1087.	876.0	348.3	162.4	63.54
	Rep 3	1615.	881.0	240.3	185.2	115.5
	mean	1351.	878.5	294.3	173.8	89.52
	se	264.0	2.47	53.97	11.40	25.98
	cv (%)	27.63	.39	25.93	9.27	41.04

Table C-1 (con't). Organic sed:ment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 30 October 1974 (light), 31 October 1974 (dark), UPPER 43, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	263.1	4409.	4672.
	Rep 2	173.6	5260.	5433.
	mean	218.3	4834.	5052.
	se	44.75	425.5	380.7
	cv (%)	28.98	12.44	10.65

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	34.68	39.19	51.32	77.51	60.42
	Rep 2	.00	9.51	17.30	38.81	36.55	71.41
	mean	.00	22.09	28.24	45.06	57.03	65.91
	se		12.58	10.94	6.25	20.48	5.49
	cv (%)		80.54	54.80	19.62	50.78	11.78

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	4624.	514.3	55.60	55.60	11.12
	mean	4624.	514.3	55.60	55.60	11.12
	se					
	cv (%)					

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	4624.	523.8	72.90	94.41	47.67
	mean	4624.	523.8	72.90	94.41	47.67
	se					
	cv (%)					

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 21 January 1975 (light), 22 January 1975 (dark), UPPER 43, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	301.4	2669.	2970.
	Rep 2	180.1	4407.	4587.
	Rep 3	223.6	......	223.6
	mean	235.0	3538.	2593.
	se	35.48	......	1273.
	cv (%)	26.14	......	85.05

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	33.36	53.37	67.43	64.58	82.60
	Rep 2	.00	3.38	12.48	39.62	54.91	69.68
	Rep 3	.00	6.47	18.11	45.29	70.53	83.19
	mean	.00	14.40	27.98	50.78	63.34	78.49
	se		9.51	12.79	8.48	4.55	4.40
	cv (%)		114.4	79.18	28.93	12.44	9.72

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	1588.	578.3	186.3	305.8	11.12
	Rep 2	3281.	639.5	425.4	52.82	8.34
	Rep 3	.....	.....	.....	.....	.....
	mean	2434.	608.9	305.8	179.3	9.73
	se	846.5	30.69	119.5	126.4	1.38
	cv (%)	49.17	7.10	55.27	99.76	20.19

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	1588.	611.6	239.6	373.2	75.70
	Rep 2	3281.	642.8	437.8	92.44	63.25
	Rep 3	.....	.....	.....	.....	.....
	mean	2434.	627.2	338.7	232.8	69.47
	se	846.5	15.61	99.10	140.4	6.22
	cv (%)	49.17	3.51	41.37	85.27	12.67

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 27 May 1975 (light), 28 May 1975 (dark), UPPER 43, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	182.3	2992.	3174.
	Rep 2	180.9	608.9	789.8
	Rep 3	174.1	1896.	2070.
	mean	179.1	1832.	2011.
	se	2.53	688.6	688.9
	cv (%)	2.44	65.10	59.32

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....	.....
	Rep 2	.00	19.07	27.03	24.72	28.71	81.35
	Rep 3	.00	32.70	28.50	41.34	56.92	14.67
	mean	.00	25.88	27.76	33.03	42.81	48.01
	se		6.81	.73	8.31	14.10	33.34
	cv (%)		37.23	3.74	35.58	46.59	98.20

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	2344.	408.7	200.2	36.14	2.78
	Rep 2	405.9	47.26	133.5	22.24	.00
	Rep 3	1499.	205.7	172.4	19.46	.00
	mean	1416.	220.5	168.7	25.94	.92
	se	561.0	104.6	19.34	5.15	.92
	cv (%)	68.60	82.14	19.86	34.44	173.2

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	405.9	66.33	160.5	46.96	28.71
	Rep 3	1499.	238.4	200.9	60.80	56.92
	mean	952.4	152.3	180.7	53.88	42.81
	se	546.5	86.93	20.18	6.92	14.10
	cv (%)	81.15	79.85	15.79	18.16	46.59

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 21 July 1975 (light), 22 July 1975 (dark), UPPER 43, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	347.2	5438.	5785.
	Rep 2	376.6	2330.	2706.
	Rep 3	260.3	4323.	4583.
	mean	328.0	4030.	4358.
	se	34.91	909.0	895.8
	cv (%)	18.43	39.06	35.60

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	3.07	18.78	38.01	86.28	201.0
	Rep 2	.....	.....	.....	.....	.....	.....
	Rep 3	.00	7.91	15.20	29.20	67.89	140.1
	mean	.00	5.49	16.99	33.60	77.08	170.5
	se		2.42	1.79	4.40	9.19	30.45
	cv (%)		62.37	14.89	18.53	16.86	25.24

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	4023.	989.8	358.7	52.82	13.90
	Rep 2	1073.	861.9	339.2	44.48	11.12
	Rep 3	3873.	283.6	122.3	41.70	2.78
	mean	2989.	711.7	273.4	46.33	9.26
	se	959.3	217.2	75.75	3.34	3.34
	cv (%)	55.57	52.86	47.99	12.49	62.45

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	4023.	992.8	377.4	90.83	100.1
	Rep 2	.....	.....	.....	.....	.....
	Rep 3	3873.	291.5	137.5	70.90	70.67
	mean	3948.	642.1	257.4	80.86	85.42
	se	75.00	350.6	119.9	9.96	14.75
	cv (%)	2.68	77.22	65.90	17.42	24.42

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 06 November 1974 (light), 07 November 1974 (dark), NAGEL SITE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	312.3	2808.	3120.
	Rep 2	482.3	2224.	2706.
	Rep 3	370.1	3951.	4321.
	mean	388.2	2994.	3382.
	se	49.90	507.1	484.2
	cv (%)	22.26	29.33	24.79

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	51.97	33.98	62.60	73.87	89.91
	Rep 2	.00	52.20	81.07	151.8	88.02	109.2
	Rep 3	.00	40.57	41.67	128.3	66.62	92.96
	mean	.00	48.24	52.24	114.2	76.17	97.35
	se		3.83	14.58	26.69	6.28	5.98
	cv (%)		13.78	48.35	40.47	14.28	10.65

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	1607.	547.7	16.68	52.82	.00
	Rep 3	3292.	417.0	136.2	105.6	.00
	mean	2449.	482.3	76.44	79.21	.00
	se	842.5	65.35	59.76	26.39	
	cv (%)	48.64	19.16	110.5	47.11	

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	1607.	599.9	97.75	204.6	88.02
	Rep 3	3292.	457.5	177.8	233.9	66.62
	mean	2449.	528.7	137.8	219.2	77.32
	se	842.5	71.16	40.06	14.64	10.70
	cv (%)	48.64	19.03	41.11	9.44	19.57

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 30 January 1975 (light), 31 January 1975 (dark), NAGEL SITE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	384.0	4145.	4529.
	Rep 2	408.8	4946.	5354.
	Rep 3	387.2	2967.	3354.
	mean	393.3	4019.	4412.
	se	7.78	574.7	580.4
	cv (%)	3.43	24.76	22.78

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	32.89	67.97	109.1	86.41	87.65
	Rep 2	.00	90.93	74.83	77.55	63.48	102.0
	Rep 3	33.58	117.8	60.14	81.72	36.47	57.47
	mean	11.19	80.54	67.64	89.45	62.12	82.37
	se	11.19	25.05	4.24	9.89	14.43	13.12
	cv (%)	173.2	53.88	10.86	19.15	40.24	27.59

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	3675.	358.7	41.70	63.95	5.56
	Rep 2	4607.	166.8	80.63	91.75	.00
	Rep 3	2638.	166.8	63.95	88.97	8.34
	mean	3640.	230.7	62.09	81.55	4.63
	se	568.6	63.96	11.27	8.84	2.45
	cv (%)	27.06	48.01	31.45	18.77	91.65

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	3675.	391.5	109.6	173.0	91.97
	Rep 2	4607.	257.7	155.4	169.3	63.48
	Rep 3	2671.	284.6	124.0	170.6	44.81
	mean	3651.	311.3	129.7	171.0	66.75
	se	558.8	40.38	13.51	1.09	13.71
	cv (%)	26.51	22.74	13.04	1.11	35.57

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan.
06 May 1975 (light), 07 May 1975 (dark), NAGEL SITE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	212.9	4849.	5061.
	Rep 2	332.7	5421.	5753.
	Rep 3	431.2	4846.	5277.
	mean	325.6	5038.	5364.
	se	63.11	191.1	204.3
	cv (%)	33.57	6.57	6.60

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	33.53	25.68	47.44	35.78	70.52
	Rep 2	70.32	8.03	18.10	47.06	99.35	89.81
	Rep 3	.....	.....	.....	.....	.....	.....
	mean	35.16	20.78	21.89	47.25	67.56	80.16
	se	35.16	12.74	3.79	.19	31.78	9.64
	cv (%)	141.4	86.72	24.48	.56	66.53	17.01

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	4104.	561.6	63.95	114.0	5.56
	Rep 2	4921.	358.7	83.41	55.60	2.78
	Rep 3	4265.	436.5	47.26	94.53	2.78
	mean	4430.	452.2	64.87	88.04	3.70
	se	249.8	59.10	10.44	17.16	.92
	cv (%)	9.76	22.63	27.88	33.77	43.30

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	4104.	595.1	89.63	161.4	41.34
	Rep 2	4991.	366.7	101.5	102.6	102.1
	Rep 3	.....	.....	.....	.....	.....
	mean	4547.	480.9	95.57	132.0	71.73
	se	443.6	114.2	5.94	29.39	30.39
	cv (%)	13.79	33.58	8.79	31.47	59.92

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 24 July 1975 (light), 25 July 1975 (dark), NAGEL SITE, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	193.9	3286.	3479.
	Rep 2	288.8	1151.	1439.
	Rep 3	313.5	1501.	1814.
	mean	265.4	1979.	2244.
	se	36.45	661.1	626.9
	cv (%)	23.79	57.85	48.37

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....	.....
	Rep 2	.00	25.61	6.51	26.38	67.27	163.0
	Rep 3	.00	16.86	36.80	98.88	77.08	83.85
	mean	.00	21.23	21.65	62.63	72.17	123.4
	se		4.37	15.14	36.25	4.90	39.57
	cv (%)		29.13	98.89	81.85	9.61	45.34

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	2402.	508.3	316.9	52.82	5.56
	Rep 2	1029.	52.82	33.36	30.58	5.56
	Rep 3	803.5	586.6	80.63	27.80	2.78
	mean	1411.	382.7	143.6	37.06	4.63
	se	499.5	166.4	87.70	7.91	.92
	cv (%)	61.29	75.34	105.7	36.99	34.64

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	1029.	73.43	39.87	56.96	72.83
	Rep 3	803.5	603.4	117.4	126.6	79.86
	mean	916.2	340.9	78.65	91.82	76.34
	se	112.7	262.5	38.77	34.86	3.51
	cv (%)	17.40	108.8	69.72	53.69	6.51

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 26 November 1974 (light), 27 November 1974 (dark), KELLOGG FOREST, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	120.8	4429.	4549.
	Rep 2	270.1	2513.	2783.
	Rep 3	253.5	3220.	3473.
	mean	214.8	3387.	3602.
	se	47.24	559.3	514.0
	cv (%)	38.09	28.60	24.71

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	3.48	11.59	14.66	39.81	51.26
	Rep 2	.00	12.84	21.62	80.22	48.03	107.4
	Rep 3	.00	23.05	15.80	31.20	102.1	81.32
	mean	.00	13.12	16.33	42.02	63.31	79.99
	se		5.64	2.90	19.68	19.53	16.22
	cv (%)		74.55	30.82	81.12	53.45	35.12

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	1248.	1051.	150.1	52.82	11.12
	Rep 3	1799.	870.2	364.2	177.9	8.34
	mean	1523.	960.6	257.1	115.3	9.73
	se	275.5	90.40	107.0	62.54	1.38
	cv (%)	25.57	13.30	58.87	76.66	20.19

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	1248.	1063.	171.7	133.0	59.15
	Rep 3	1799.	893.2	380.0	209.1	110.4
	mean	1523.	978.5	275.8	171.0	84.79
	se	275.5	85.29	104.1	38.03	25.64
	cv (%)	25.57	12.32	53.38	31.43	42.77

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan.
13 May 1975 (light), 14 May 1975 (dark), KELLOGG FOREST, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	335.8	1105.	1440.
	Rep 2	379.6	2174.	2553.
	Rep 3	351.0	1579.	1930.
	mean	355.4	1619.	1974.
	se	12.83	309.2	322.0
	cv (%)	6.25	33.07	28.24

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.00	7.39	29.03	85.93	74.65	138.8
	Rep 2	.....	.....	.....	.....	.....	.....
	Rep 3	.00	12.91	43.79	130.1	64.82	99.32
	mean	.00	10.15	36.41	108.0	69.73	119.0
	se		2.75	7.38	22.08	4.91	19.74
	cv (%)		38.39	28.66	28.91	9.96	23.44

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	471.3	508.8	97.31	27.80	.00
	Rep 2	1207.	825.7	83.41	50.04	8.34
	Rep 3	1065.	350.3	125.1	36.14	2.78
	mean	914.4	561.6	101.9	37.99	3.70
	se	225.3	139.7	12.25	6.48	2.45
	cv (%)	42.68	43.10	20.82	29.57	114.5

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	471.3	516.2	126.3	113.7	74.65
	Rep 2	.....	.....	.....	.....	.....
	Rep 3	1065.	363.2	168.8	166.2	67.60
	mean	768.1	439.7	147.6	139.9	71.12
	se	296.8	76.49	21.27	26.25	3.52
	cv (%)	54.65	24.60	20.38	26.52	7.00

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 06 February 1975 (light), 05 February 1975 (dark), KELLOGG FOREST, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	......	......	......
	Rep 2	178.6	2241.	2419.
	Rep 3	395.4	3175.	3570.
	mean	287.0	2708.	2994.
	se	108.4	46700	575.5
	cv (%)	53.4	24.38	27.17

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....	.....
	Rep 2	.00	.00	20.06	57.48	45.11	56.00
	Rep 3	.00	7.68	27.29	109.8	109.8	140.8
	mean	.00	3.84	23.67	83.64	77.45	98.40
	se		3.84	3.61	26.16	32.34	42.40
	cv (%)		141.4	21.59	44.23	59.05	60.93

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	1479.	494.9	183.5	83.41	.00
	Rep 3	2388.	614.4	91.75	72.29	8.34
	mean	1933.	554.6	137.6	77.85	4.17
	se	454.5	59.75	45.87	5.56	4.17
	cv (%)	33.24	15.23	47.14	10.10	141.4

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	1479.	494.9	203.5	140.8	45.11
	Rep 3	2388.	622.0	119.0	182.0	118.1
	mean	1933.	558.4	161.3	161.4	81.62
	se	454.5	63.59	42.26	20.60	36.51
	cv (%)	33.24	16.19	37.05	18.04	63.26

Table C-1 (con't). Organic sediment composition (g AFDW) for selected sites on Augusta Creek, Michigan. 28 July 1975 (light), 29 July 1975 (dark), KELLOGG FOREST, STANDARD RUN

		DETRITUS	EPILITHON	TOTAL
g AFDW/m2	Rep 1	246.3	2789.	3035.
	Rep 2	293.1	1474.	1767.
	Rep 3	278.4	4696.	4974.
	mean	272.6	2986.	3258.
	se	13.81	935.3	932.5
	cv (%)	8.78	54.24	49.56

		16mm	4mm	1mm	250um	75um	0.45um
g DETRITUS/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....	.....
	Rep 2	.00	12.07	12.51	107.3	51.18	110.0
	Rep 3	.00	.87	11.08	108.9	60.07	97.48
	mean	.00	6.47	11.79	108.1	55.62	103.7
	se		5.59	.71	.79	4.44	6.26
	cv (%)		122.2	8.57	1.04	11.30	8.53

		16mm	4mm	1mm	250um	75um
g EPILITHON/m2 BY PARTICLE SIZE	Rep 1	1212.	1176.	355.9	41.70	2.78
	Rep 2	586.6	689.5	164.0	33.36	.00
	Rep 3	1721.	2619.	322.5	30.58	2.78
	mean	1173.	1494.	280.8	35.21	1.85
	se	328.0	579.3	59.19	3.34	.92
	cv (%)	48.43	67.13	36.51	16.43	86.60

		16mm	4mm	1mm	250um	75um
g TOTAL/m2 BY PARTICLE SIZE	Rep 1	.....	.....	.....	.....	.....
	Rep 2	586.6	701.5	176.5	140.6	51.18
	Rep 3	1721.	2619.	333.5	139.4	62.85
	mean	1153.	1660.	255.0	140.0	57.01
	se	567.2	959.1	78.53	.59	5.83
	cv (%)	69.52	81.67	43.54	.59	14.47

APPENDIX D

Table D-1. Summary of physical parameters for selected riffle sections of SMITH SITE, Augusta Creek, Michigan.

DATE	TEMPERATURE (C) range	TEMPERATURE (C) mean	OXYGEN (mg/liter) range	OXYGEN (mg/liter) mean	INCIDENT LIGHT (lux) range	INCIDENT LIGHT (lux) mean
24 Oct. 1974 (light)	5.1 - 11.8	8.2	.... -	....	161 - 25800	10940
25 Oct. 1974 (dark)	8.0 - 9.9	8.6	.... -	....	1069 - 24800	12330
15 Jan. 1975 (light)	.2 - 1.7	1.0	.... -	....	181 - 23700	7926
16 Jan. 1975 (dark)	.9 - 1.9	1.5	.... -	....	646 - 19400	9846
20 May 1975 (light)	13.0 - 19.0	16.5	.... -	....	42 - 77500	19083
21 May 1975 (dark)	15.5 - 19.2	17.6	.... -	....	7970 - 49500	23358
17 July 1975 (light)	12.8 - 19.9	16.8	.... -	....	99 - 40900	6268
18 July 1975 (dark)	13.6 - 16.3	15.3	.... -	....	2589 - 11800	6680

Table D-2. Summary of physical parameters for selected riffle sections of B AVENUE, Augusta Creek, Michigan.

DATE	TEMPERATURE (C) range	TEMPERATURE (C) mean	OXYGEN (mg/liter) range	OXYGEN (mg/liter) mean	INCIDENT LIGHT (lux) range	INCIDENT LIGHT (lux) mean
26 Jan. 1973 (light)	.... -	....	.... -	....	538 - 23700	12320
25 Jan. 1973 (dark)	.... -	....	.... -	....	502 - 26900	13560
07 June 1973 (light)	.... -	....	.... -	....	147 - 21500	7102
06 June 1973 (dark)	15.6 - 17.3	16.3	.... -	....	538 - 19400	6324
07 June 1973 (light)	.... -	....	.... -	....	147 - 21500	7102
05 July 1973 (light)	13.1 - 18.1	15.8	9.1 - 10.3	9.7	108 - 43100	6107
04 July 1973 (dark)	14.3 - 17.2	15.5	9.5 - 10.0	9.9	861 - 34400	7782
02 Aug. 1973 (light)	15.2 - 17.7	16.4	9.2 - 10.0	9.6	108 - 64600	8017
01 Aug. 1973 (dark)	15.9 - 19.1	17.0	9.0 - 9.8	9.5	1610 - 91500	14607
29 Aug. 1973 (light)	15.2 - 19.9	17.6	7.8 - 10.0	9.2	161 - 38800	9445
30 Aug. 1973 (dark)	15.3 - 17.2	16.2	8.3 - 9.8	9.5	861 - 9900	5490
27 Sep. 1973 (light)	14.3 - 17.1	15.9	6.8 - 8.0	7.9	108 - 15100	4795
26 Sep. 1973 (dark)	14.1 - 17.7	15.8	6.7 - 9.2	7.4	2480 - 23700	9799
05 Nov. 1973 (light)	5.0 - 5.6	5.3	9.3 - 9.6	9.4	123 - 21500	8523
06 Nov. 1973 (dark)	3.5 - 5.5	4.7	10.1 - 10.6	10.3	495 - 38800	16931
11 Dec. 1973 (light)	1.8 - 3.0	2.3	11.0 - 11.7	11.4	266 - 17200	8893
12 Dec. 1973 (dark)	.5 - 3.0	2.1	10.4 - 11.8	10.7	861 - 21500	12013
23 Jan. 1974 (light)	.7 - 1.8	1.1	10.8 - 11.4	11.1	158 - 30100	8979
22 Jan. 1974 (dark)	1.0 - 1.7	1.2	10.9 - 11.2	11.0	1290 - 6890	4140
05 Mar. 1974 (light)	1.6 - 6.9	4.5	9.6 - 11.5	10.4	..... -	.....
04 Mar. 1974 (dark)	2.3 - 2.9	2.4	10.5 - 11.0	10.7	..... -	.....
09 Apr. 1974 (light)	1.4 - 9.7	5.9	9.7 - 12.0	10.9	269 - 86100	37387
10 Apr. 1974 (dark)	2.0 - 12.5	7.4	8.9 - 11.8	10.5	9690 - 81800	47709
15 May 1974 (light)	10.5 - 15.0	12.9	7.8 - 8.5	8.2	256 - 88300	25558
16 May 1974 (dark)	9.6 - 10.2	9.9	8.4 - 9.1	8.7	..... -	.....

Table D-2 (con't). Summary of physical parameters for selected riffle sections of B AVENUE, Augusta Creek, Michigan.

DATE	TEMPERATURE (C) range	TEMPERATURE (C) mean	OXYGEN (mg/liter) range	OXYGEN (mg/liter) mean	INCIDENT LIGHT (lux) range	INCIDENT LIGHT (lux) mean
17 Oct. 1974 (light)	6.8 - 10.6	8.7	.... -	....	227 - 38800	17181
18 Oct. 1974 (dark)	4.9 - 6.9	5.8	.... -	....	2580 - 25800	14156
09 Jan. 1975 (light)	1.0 - 2.1	1.6	.... -	....	55 - 6670	3088
08 Jan. 1975 (dark)	1.7 - 2.0	2.0	.... -	....	409 - 5170	2391
16 Apr. 1975 (light)	3.3 - 10.8	7.1	.... -	....	207 - 90400	23764
17 Apr. 1975 (dark)	3.5 - 12.8	9.9	.... -	....	11200 - 95800	43430
14 July 1975 (light)	12.7 - 14.3	13.4	.... -	....	47 - 9470	3493
15 July 1975 (dark)	12.4 - 17.0	14.3	.... -	....	1720 - 15100	6301

Table D-3. Summary of physical parameters for selected riffle sections of UPPER 43, Augusta Creek, Michigan.

DATE	TEMPERATURE (C) range	TEMPERATURE (C) mean	OXYGEN (mg/liter) range	OXYGEN (mg/liter) mean	INCIDENT LIGHT (lux) range	INCIDENT LIGHT (lux) mean
30 Oct. 1974 (light)	10.9 - 13.8	12.4	.... -	....	215 - 34400	16885
31 Oct. 1974 (dark)	13.2 - 15.8	14.6	.... -	....	7840 - 49500	24456
21 Jan. 1975 (light)	.1 - .6	.4	.... -	....	215 - 32300	12208
22 Jan. 1975 (dark)	.3 - 1.7	.9	.... -	....	3010 - 33400	20458
27 May 1975 (light)	18.3 - 24.4	21.7	.... -	....	54 - 98500	54077
28 May 1975 (dark)	16.8 - 21.7	19.0	8.0 - 8.4	8.3	1000 - 96900	90213
21 July 1975 (light)	17.7 - 24.8	21.4	.... -	....	108 - 96900	45652
22 July 1975 (dark)	16.7 - 23.9	20.2	.... -	....	1000 - 92600	85024

Table D-4. Summary of physical parameters for selected riffle sections of NAGEL SITE, Augusta Creek, Michigan.

DATE	TEMPERATURE (C) range	TEMPERATURE (C) mean	OXYGEN (mg/liter) range	OXYGEN (mg/liter) mean	INCIDENT LIGHT (lux) range	INCIDENT LIGHT (lux) mean
08 Aug. 1973 (light)	20.2 - 24.4	22.6	.... -	....	818 - 79700	36262
09 Aug. 1973 (dark)	21.7 - 23.4	22.6	8.6 - 10.4	9.7	7000 - 68900	37803
04 Sep. 1973 (light)	20.6 - 24.0	22.6	8.8 - 11.3	10.2	392 - 60300	31201
05 Sep. 1973 (dark)	20.0 - 22.8	21.5	9.4 - 10.8	10.2	8630 - 53800	29198
04 Oct. 1973 (light)	15.2 - 16.3	15.6	7.1 - 7.7	7.5	646 - 24800	10239
03 Oct. 1973 (dark)	15.0 - 16.8	15.8	7.6 - 8.4	8.1	15100 - 38800	23752
12 Nov. 1973 (light)	4.7 - 6.5	5.8	11.8 - 13.2	12.5	108 - 40900	15938
13 Nov. 1973 (dark)	6.3 - 8.2	7.3	10.8 - 12.1	11.4	2480 - 29100	13758
18 Dec. 1973 (light)	.1 - 2.0	1.2	12.0 - 12.3	12.3	108 - 4310	2824
31 Jan. 1974 (light)	2.6 - 3.4	3.0	10.9 - 12.0	11.3	108 - 64600	22106
01 Feb. 1974 (dark)	.0 - .0	.0	12.0 - 12.3	12.1	..... -	.....
20 Mar. 1974 (light)	2.6 - 6.1	4.4	11.1 - 12.1	11.6	431 - 96900	38169
21 Mar. 1974 (dark)	3.2 - 6.0	4.2	11.2 - 12.1	11.8	13600 - 92600	53139
23 Apr. 1974 (light)	9.0 - 10.0	9.8	8.4 - 11.1	10.0	108 - 71000	17774
22 Apr. 1974 (dark)	13.6 - 16.7	15.3	7.3 - 10.9	9.2	2690 - 86100	48734
24 Apr. 1974 (light)	6.8 - 10.6	8.7	11.5 - 12.1	11.8	32000 - 88300	81822
22 Apr. 1974 (dark)	13.6 - 16.7	15.0	7.8 - 10.9	9.2	2690 - 86100	49226
29 May 1974 (light)	15.1 - 19.1	16.6	7.4 - 8.3	8.1	215 - 71000	21849
29 May 1974 (dark)	16.8 - 19.1	17.9	6.4 - 7.8	7.1	0 - 309	
01 July 1974 (light)	17.0 - 23.0	20.3	6.9 - 8.2	7.3	46 - 91500	49025
01 July 1974 (dark)	19.2 - 22.0	20.7	5.5 - 6.2	5.7	0 - 635	
05 Aug. 1974 (light)	14.2 - 19.7	17.3	6.6 - 8.6	7.7	215 - 98000	47598
05 Aug. 1974 (dark)	14.2 - 19.7	17.3	6.6 - 8.6	7.7	1510 - 98000	50359
06 Nov. 1974 (light)	6.4 - 7.4	6.9	.... -	....	280 - 26900	12624
07 Nov. 1974 (dark)	4.9 - 6.9	5.3	.... -	....	10800 - 49500	36217

Table D-4 (con't). Summary of physical parameters for selected riffle sections of NAGEL SITE, Augusta Creek, Michigan.

DATE	TEMPERATURE (C) range	TEMPERATURE (C) mean	OXYGEN (mg/liter) range	OXYGEN (mg/liter) mean	INCIDENT LIGHT (lux) range	INCIDENT LIGHT (lux) mean
30 Jan. 1975 (light)	-.1 - .8	.4	.... -	....	54 - 40900	17803
31 Jan. 1975 (dark)	.2 - 2.3	1.5	.... -	....	323 - 10800	5015
06 May 1975 (light)	12.5 - 17.5	14.8	.... -	....	251 - 86100	45092
07 May 1975 (dark)	11.9 - 17.6	15.0	.... -	....	2000 - 96900	84631
06 May 1975 (light)	12.5 - 17.5	14.8	.... -	....	251 - 86100	45092
07 May 1975 (dark)	11.9 - 17.6	14.8	.... -	....	5000 - 94700	82817
24 July 1975 (light)	20.5 - 23.9	22.1	.... -	....	207 - 99000	34324
25 July 1975 (dark)	18.0 - 21.5	19.5	.... -	....	3000 - 99000	64382

Table D-5. Summary of physical parameters for selected riffle sections of KELLOGG FOREST, Augusta Creek, Michigan.

DATE	TEMPERATURE (C)		OXYGEN (mg/liter)		INCIDENT LIGHT (lux)	
	range	mean	range	mean	range	mean
26 Nov. 1974 (light)	1.0 - 2.0	1.5	.... -	....	375 - 24800	12664
27 Nov. 1974 (dark)	1.0 - 1.7	1.4	.... -	....	861 - 15100	6406
06 Feb. 1975 (light)	1.0 - 1.1	1.1	.... -	....	366 - 23700	9229
05 Feb. 1975 (dark)	1.8 - 1.8	1.8	.... -	....	484 - 17200	7837
13 May 1975 (light)	12.2 - 18.7	15.4	.... -	....	280 - 98000	56725
14 May 1975 (dark)	13.5 - 15.3	14.2	.... -	....	4950 - 73200	32203
28 July 1975 (light)	16.4 - 22.2	19.0	.... -	....	161 - 96900	33392
29 July 1975 (dark)	16.3 - 21.0	18.2	.... -	....	7000 - 98000	71840

APPENDIX E

N = number of values considered
R = multiple correlation coefficient
S.E.= standard error of regression
F ratio= test of significance for regression
    <1 no significance
    >1 significant, higher more so

M^2Reg= mean^2 of deviation due to regression
M^2Res= mean^2 of deviation of residuals

P= level of significance ($P=0.05$ significant)

Table E - 1. Regression parameters for average NCP, CR, GCP and NDM versus various independent variables from data collected in Augusta Creek, Michigan riffle sections.

Dependent Variable	Independent Variable	N	R	S.E.	M^2 Reg	M^2 Res	F Ratio	P
$\bar{X}$ NCP	Order	103	0.740	0.056	0.380	0.003	121.9	0.000
	$\bar{X}$ Light	101	0.517	0.071	0.183	0.005	36.0	0.000
	$\bar{X}$ Temperature	102	0.328	0.079	0.075	0.006	12.0	0.001
	$\bar{X}$ AFDW	96	0.117	0.077	0.008	0.006	1.3	0.255
	$\bar{X}$ EAFDW	85	0.419	0.064	0.073	0.004	17.6	0.000
	$\bar{X}$ TAFDW	85	0.410	0.065	0.070	0.004	16.8	0.000
$\bar{X}$ CR	Order	104	0.519	0.033	0.042	0.001	37.5	0.000
	$\bar{X}$ Temperature	103	0.640	0.030	0.063	0.001	70.0	0.000
	$\bar{X}$ AFDW	96	0.081	0.039	0.001	0.002	0.6	0.435
	$\bar{X}$ EAFDW	85	0.306	0.038	0.013	0.001	8.6	0.004
	$\bar{X}$ TAFDW	85	0.302	0.384	0.012	0.001	8.3	0.005
$\bar{X}$ GCP	Order	101	0.722	0.078	0.660	0.006	108.1	0.000
	$\bar{X}$ Light	100	0.565	0.093	0.401	0.009	46.0	0.000
	$\bar{X}$ Temperature	100	0.414	0.103	0.216	0.011	20.3	0.000
	$\bar{X}$ AFDW	94	0.100	0.107	0.011	0.012	0.9	0.335
	$\bar{X}$ EAFDW	83	0.393	0.094	0.130	0.009	14.8	0.002
	$\bar{X}$ TAFDW	83	0.386	0.094	0.125	0.009	14.2	0.000
$\bar{X}$ NDM	Order	101	0.655	0.639	30.323	0.409	74.2	0.000
	$\bar{X}$ Light	100	0.534	0.717	20.146	0.514	39.2	0.000
	$\bar{X}$ Temperature	100	0.339	0.800	8.123	0.639	12.7	0.001
	$\bar{X}$ AFDW	94	0.121	0.735	0.742	0.540	1.4	0.244
	$\bar{X}$ EAFDW	83	0.296	0.673	3.511	0.453	7.8	0.007
	$\bar{X}$ TAFDW	83	0.286	0.675	3.274	0.456	7.2	0.009

Table E - 2. Regression parameters for individual rates of NCP and CR versus various independent variables from data collected in Augusta Creek, Michigan riffle sections.

Dependent Variable	Independent Variable	N	R	S.E.	M^2Reg	M^2Res	F Ratio	P
NCP	Light	666	0.598	0.086	8.014	0.007	1089.7	0.000
	Temperature	1957	0.182	0.105	0.744	0.011	67.1	0.000
	T + L *	1957	0.598	0.086	4.007	0.007	544.6	0.000
	L		0.597					
	T		0.005					
CR	Temperature	1189	0.523	0.035	0.558	0.001	447.1	0.000
	T + L	1189	0.567	0.034	0.328	0.001	281.5	0.000
	L		0.241					
	T		0.425					

* = multiple regression - temperature + light.

Table E - 3. Regression analyses for various sites of Augusta Creek, Michigan

SMITH

Dependent Variable	Independent Variable	N	R	S.E.	M^2Reg	M^2Res	F Ratio	P
$\bar{X}$ NCP	$\bar{X}$ Light	12	0.270	0.008	0.000	0.000	0.786	0.396
	$\bar{X}$ Temperature	12	0.0003	0.009	0.000	0.000	0.000	0.999
	$\bar{X}$ AFDW	12	0.131	0.009	0.000	0.000	0.175	0.684
	$\bar{X}$ EAFDW	12	0.759	0.006	0.000	0.000	13.601	0.004
	$\bar{X}$ TAFDW	12	0.728	0.006	0.000	0.000	11.244	0.007
$\bar{X}$ CR	$\bar{X}$ Temperature	12	0.013	0.010	0.000	0.000	0.002	0.968
	$\bar{X}$ AFDW	12	0.354	0.009	0.000	0.000	1.434	0.259
	$\bar{X}$ EAFDW	12	0.381	0.009	0.000	0.000	1.699	0.222
	$\bar{X}$ TAFDW	12	0.456	0.009	0.000	0.000	2.618	0.137
$\bar{X}$ GCP	$\bar{X}$ Light	12	0.255	0.007	0.000	0.000	0.695	0.424
	$\bar{X}$ Temperature	12	0.022	0.007	0.000	0.000	0.005	0.946
	$\bar{X}$ AFDW	12	0.316	0.007	0.000	0.000	1.112	0.316
	$\bar{X}$ EAFDW	12	0.405	0.007	0.000	0.000	1.966	0.191
	$\bar{X}$ TAFDW	12	0.268	0.007	0.000	0.000	0.771	0.401
$\bar{X}$ NDM	$\bar{X}$ Light	12	0.233	0.203	0.024	0.041	0.573	0.467
	$\bar{X}$ Temperature	12	0.133	0.207	0.008	0.043	0.180	0.680
	$\bar{X}$ AFDW	12	0.318	0.198	0.044	0.039	1.126	0.314
	$\bar{X}$ EAFDW	12	0.660	0.157	0.189	0.025	7.696	0.020
	$\bar{X}$ TAFDW	12	0.696	.150	0. 211	0.022	9.393	0.012

Table E - 3. cont.

B AVENUE

Dependent Variable	Independent Variable	N	R	S.E.	M^2 Reg	M^2 Res	F Ratio	P
$\bar{X}$ NCP	$\bar{X}$ Light	33	0.160	0.009	0.000	0.000	0.812	0.374
	$\bar{X}$ Temperature	35	0.047	0.008	0.000	0.000	0.072	0.790
	$\bar{X}$ AFDW	30	0.024	0.008	0.000	0.000	0.016	0.900
	$\bar{X}$ EAFDW	24	0.206	0.007	0.000	0.000	0.979	0.333
	$\bar{X}$ TAFDW	24	0.174	0.007	0.000	0.000	0.686	0.416
$\bar{X}$ CR	$\bar{X}$ Temperature	34	0.785	0.007	0.002	0.000	51.292	0.000
	$\bar{X}$ AFDW	29	0.172	0.010	0.000	0.000	0.826	0.372
	$\bar{X}$ EAFDW	23	0.191	0.010	0.000	0.000	0.796	0.382
	$\bar{X}$ TAFDW	23	0.271	0.010	0.000	0.000	1.668	0.211
$\bar{X}$ GCP	$\bar{X}$ Light	33	0.072	0.014	0.000	0.000	0.162	0.690
	$\bar{X}$ Temperature	34	0.600	0.011	0.002	0.000	17.861	0.000
	$\bar{X}$ AFDW	29	0.117	0.013	0.000	0.000	0.372	0.547
	$\bar{X}$ EAFDW	23	0.239	0.014	0.000	0.000	1.270	0.273
	$\bar{X}$ TAFDW	23	0.277	0.013	0.000	0.000	1.739	0.201
$\bar{X}$ NDM	$\bar{X}$ Light	33	0.121	0.149	0.010	0.022	0.457	0.504
	$\bar{X}$ Temperature	34	0.368	0.138	0.096	0.019	5.002	0.032
	$\bar{X}$ AFDW	29	0.181	0.146	0.019	0/021	0.917	0.347
	$\bar{X}$ EAFDW	23	0.101	0.112	0.003	0.014	0.215	0.648
	$\bar{X}$ TAFDW	23	0.022	0.119	0.000	0.014	0.011	0.919

Table E - 3. cont.

UPPER 43RD

Dependent Variable	Independent Variable	N	R	S.E.	M^2 Reg	M^2 Res	F Ratio	P
$\bar{X}$ NCP	$\bar{X}$ Light	10	0.405	0.070	0.008	0.005	1.569	0.246
	$\bar{X}$ Temperature	10	0.547	0.064	0.014	0.004	3.413	0.102
	$\bar{X}$ AFDW	10	0.281	0.074	0.004	0.005	0.687	0.431
	$\bar{X}$ EAFDW	9	0.039	0.076	0.000	0.006	0.007	0.935
	$\bar{X}$ TAFDW	9	0.048	0.076	0.000	0.006	0.016	0.902
$\bar{X}$ CR	$\bar{X}$ Temperature	11	0.898	0.018	0.012	0.000	37.649	0.000
	$\bar{X}$ AFDW	11	0.194	0.041	0.001	0.002	0.351	0.568
	$\bar{X}$ EAFDW	10	0.159	0.039	0.000	0.001	0.206	0.662
	$\bar{X}$ TAFDW	10	0.166	0.038	0.000	0.001	0.226	0.648
$\bar{X}$ GCP	$\bar{X}$ Light	10	0.484	0.095	0.020	0.009	2.444	0.157
	$\bar{X}$ Temperature	10	0.677	0.080	0.043	0.006	6.768	0.032
	$\bar{X}$ AFDW	10	0.135	0.108	0.002	0.012	0.149	0.710
	$\bar{X}$ EAFDW	9	0.004	0.105	0.000	0.011	0.000	0.992
	$\bar{X}$ TAFDW	9	0.005	0.105	0.000	0.011	0.000	0.990
$\bar{X}$ NDM	$\bar{X}$ Light	10	0.609	0.711	2.381	0.505	4.713	0.062
	$\bar{X}$ Temperature	10	0.519	0.766	1.728	0.587	2.944	0.125
	$\bar{X}$ AFDW	10	0.340	0.843	0.742	0.710	1.045	0.337
	$\bar{X}$ EAFDW	9	0.372	0.861	0.835	0.742	1.126	0.324
	$\bar{X}$ TAFDW	9	0.388	0.855	0.905	0.732	1.237	0.303

Table E - 3. cont.

NAGEL

Dependent Variable	Independent Variable	N	R	S.E.	M^2 Reg	M^2 Res	F Ratio	P
$\bar{X}$ NCP	$\bar{X}$ Light	35	0.241	0.078	0.012	0.006	2.035	0.163
	$\bar{X}$ Temperature	35	0.377	0.075	0.030	0.006	5.453	0.026
	$\bar{X}$ AFDW	33	0.179	0.071	0.005	0.005	1.031	0.318
	$\bar{X}$ EAFDW	29	0.083	0.063	0.001	0.004	0.189	0.667
	$\bar{X}$ TAFDW	29	0.080	0.063	0.001	0.004	0.175	0.679
$\bar{X}$ CR	$\bar{X}$ Temperature	34	0.742	0.029	0.034	0.001	39.298	0.000
	$\bar{X}$ AFDW	33	0.308	0.042	0.006	0.002	3.243	0.081
	$\bar{X}$ EAFDW	29	0.198	0.045	0.002	0.002	1.104	0.303
	$\bar{X}$ TAFDW	29	0.213	0.045	0.003	0.002	1.286	0.267
$\bar{X}$ GCP	$\bar{X}$ Light	34	0.383	0.099	0.054	0.010	5.496	0.025
	$\bar{X}$ Temperature	34	0.529	0.091	0.102	0.008	12.417	0.001
	$\bar{X}$ AFDW	32	0.254	0.098	0.020	0.010	2.062	0.161
	$\bar{X}$ EAFDW	28	0.066	0.095	0.001	0.009	0.113	0.740
	$\bar{X}$ TAFDW	28	0.074	0.095	0.001	0.009	0.141	0.710
$\bar{X}$ NCP	$\bar{X}$ Light	34	0.263	0.930	2.050	0.864	2.373	0.133
	$\bar{X}$ Temperature	34	0.417	0.876	5.171	0.766	6.747	0.014
	$\bar{X}$ AFDW	32	0.131	0.740	0.287	0.548	0.524	0.475
	$\bar{X}$ EAFDW	28	0.181	0.705	0.437	0.496	0.881	0.357
	$\bar{X}$ TAFDW	28	0.182	0.705	0.440	0.496	0.887	0.355

Table E - 3. cont.

KELLOGG FOREST

Dependent Variable		Independent Variable	N	R	S.E.	M^2 Reg	M^2 Res	F Ratio	P
$\bar{X}$	NCP	$\bar{X}$ Light	11	0.425	0.030	0.002	0.001	1.984	0.193
		$\bar{X}$ Temperature	10	0.361	0.031	0.001	0.001	1.200	0.305
		$\bar{X}$ AFDW	11	0.271	0.032	0.001	0.001	0.711	0.421
		$\bar{X}$ EAFDW	11	0.381	0.031	0.001	0.001	1.523	0.248
		$\bar{X}$ TAFDW	11	0.372	0.031	0.001	0.001	1.447	0.260
$\bar{X}$	CR	$\bar{X}$ Temperature	12	0.765	0.016	0.003	0.000	14.079	0.004
		$\bar{X}$ AFDW	11	0.056	0.024	0.000	0.001	0.029	0.869
		$\bar{X}$ EAFDW	11	0.168	0.024	0.000	0.001	0.260	0.510
		$\bar{X}$ TAFDW	11	0.177	0.024	0.000	0.001	0.291	0.603
$\bar{X}$	GCP	$\bar{X}$ Light	11	o.531	0.039	0.005	0.002	3.533	0.093
		$\bar{X}$ Temperature	10	0.660	0.034	0.007	0.001	6.157	0.038
		$\bar{X}$ AFDW	11	0.225	0.052	0.001	0.002	0.478	0.507
		$\bar{X}$ EAFDW	11	0.186	0.046	0.001	0.002	0.321	0.585
		$\bar{X}$ TAFDW	11	0.175	0.046	0.001	0.002	0.283	0.608
$\bar{X}$	NCP	$\bar{X}$ Light	11	0.637	0.353	0.765	0.124	6.146	0.035
		$\bar{X}$ Temperature	10	0.512	0.398	0.500	0.158	2.838	0.131
		$\bar{X}$ AFDW	11	0.473	0.403	0.422	0.168	2.598	0.141
		$\bar{X}$ EAFDW	11	0.564	0.352	0.773	0.124	6.254	0.034
		$\bar{X}$ TAFDW	11	0.625	0.357	0.737	0.128	5.769	0.040

APPENDIX F

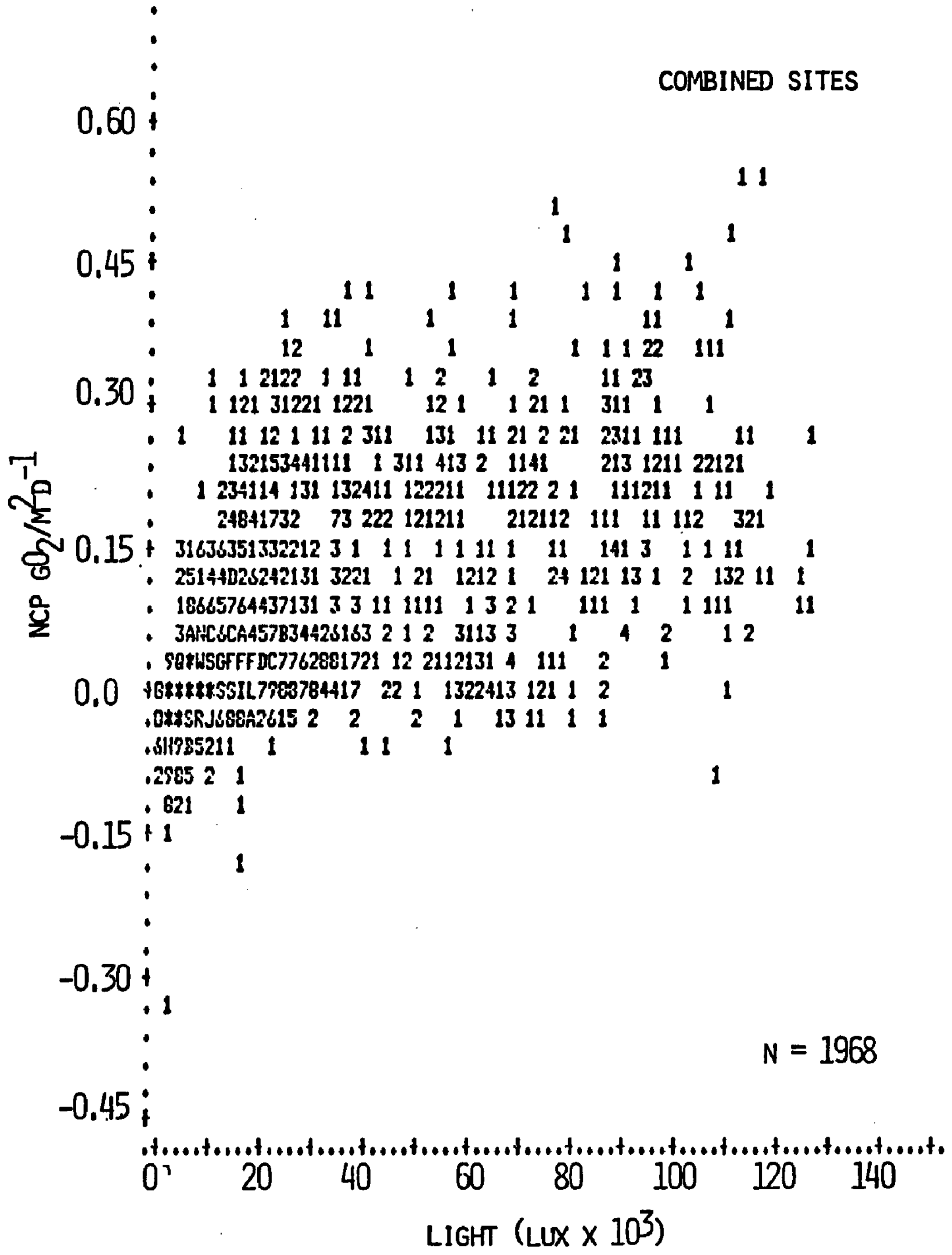

Figure F - 1. Net community productivity at various light intensities for combined sites of Augusta Creek, Michigan (1973-1975).

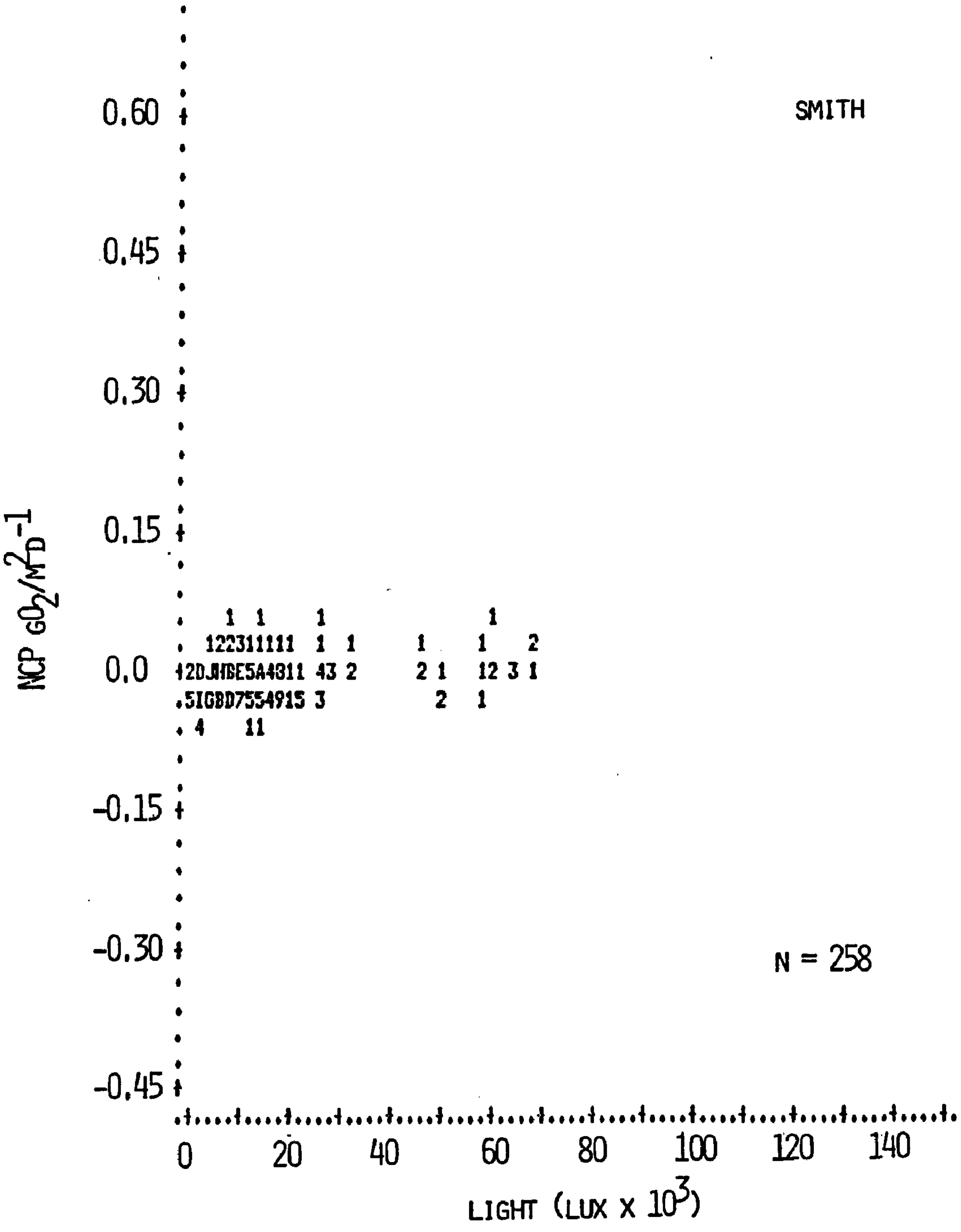

Figure F - 2. Net community productivity at various light intensities for Smith site, Augusta Creek, Michigan (1975 - 1975).

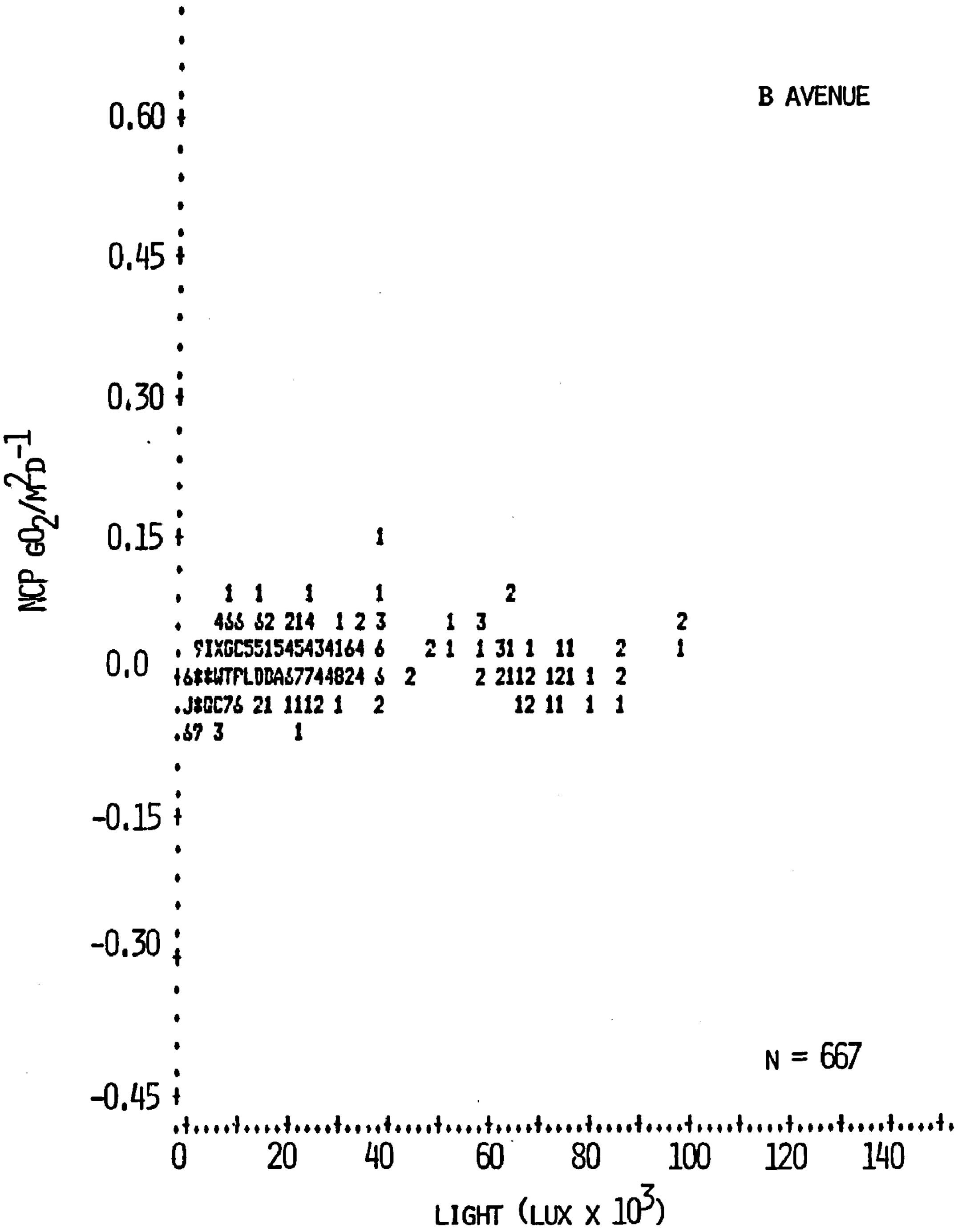

Figure F - 3. Net community productivity at various light intensities for B Avenue site, Augusta Creek, Michigan (1973 - 1975).

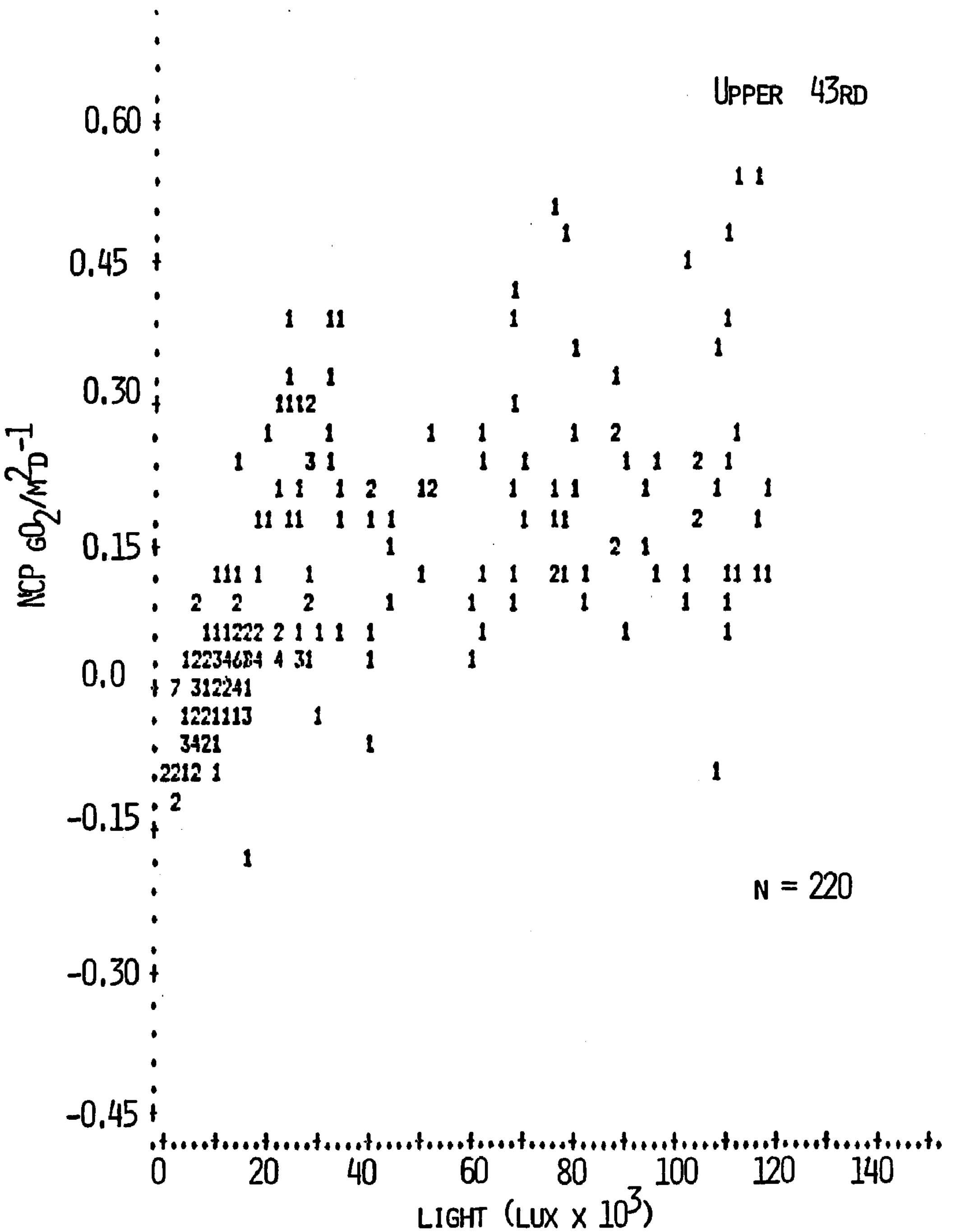

Figure F - 4. Net community productivity at various light intensities for Upper 43rd site, Augusta Creek, Michigan (1974 - 1975).

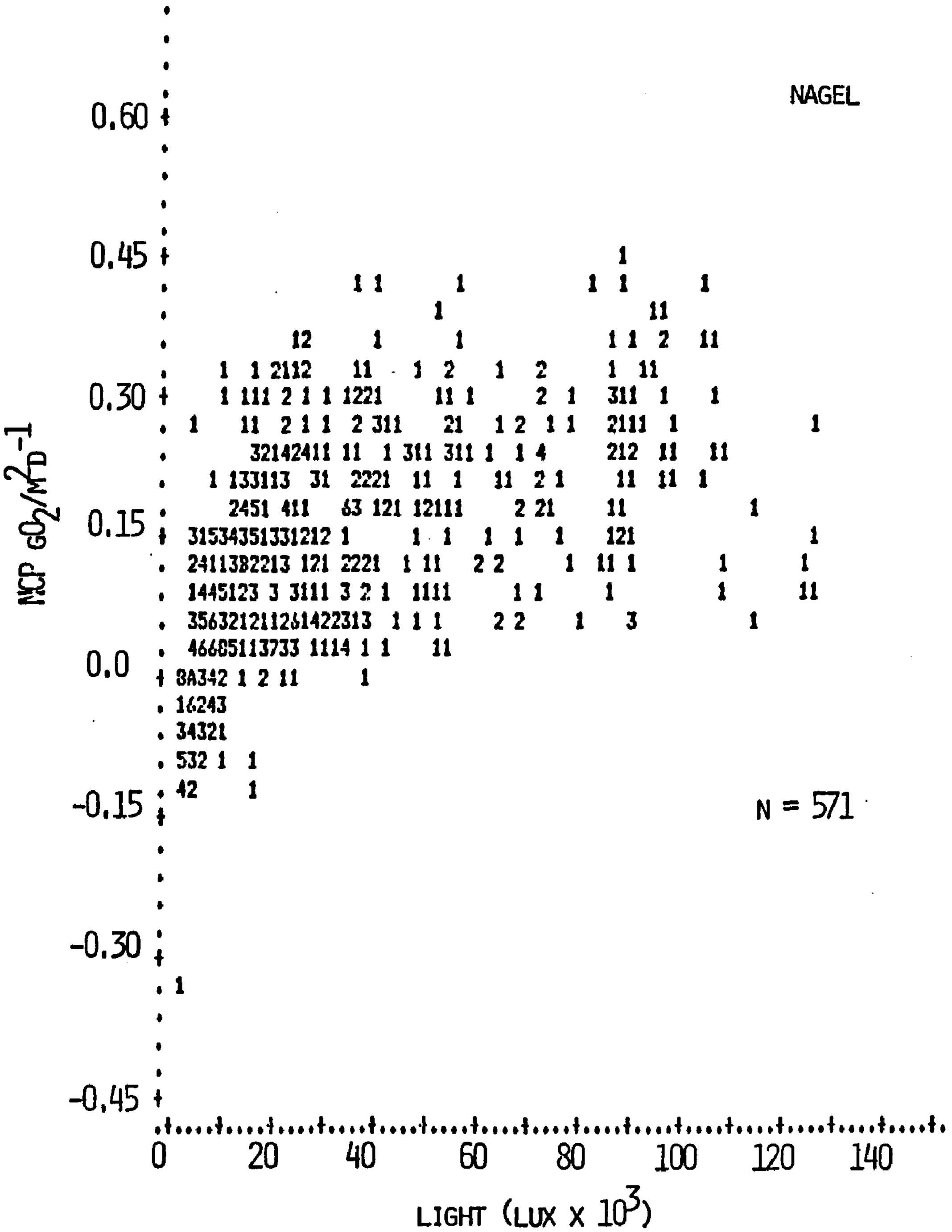

Figure F - 5. Net community productivity at various light intensities for Nagel site, Augusta Creek, Michigan (1973 - 1975).

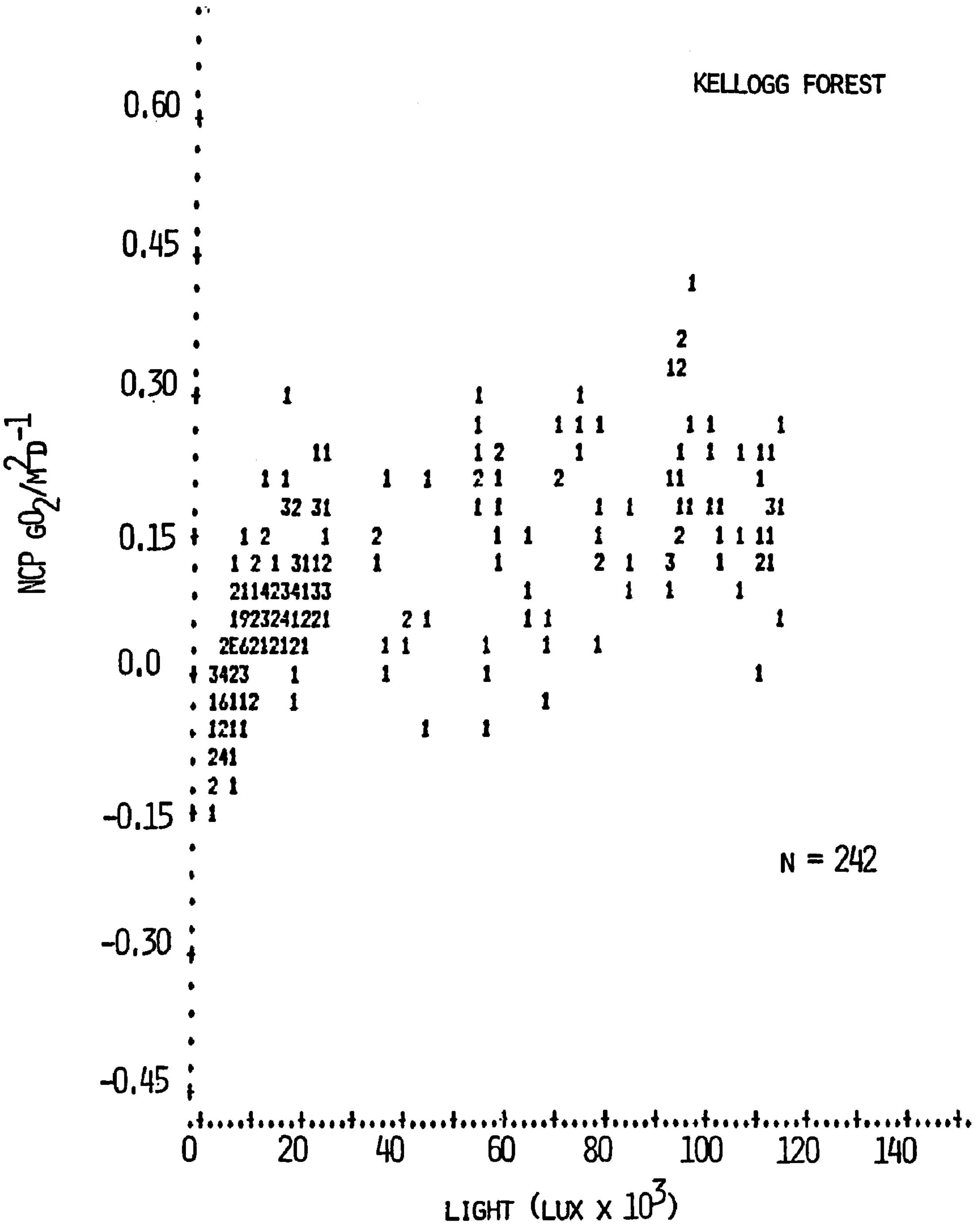

Figure F - 6. Net community productivity at various light intensities for Kellogg Forest site, Augusta Creek, Michigan (1974 - 1975).

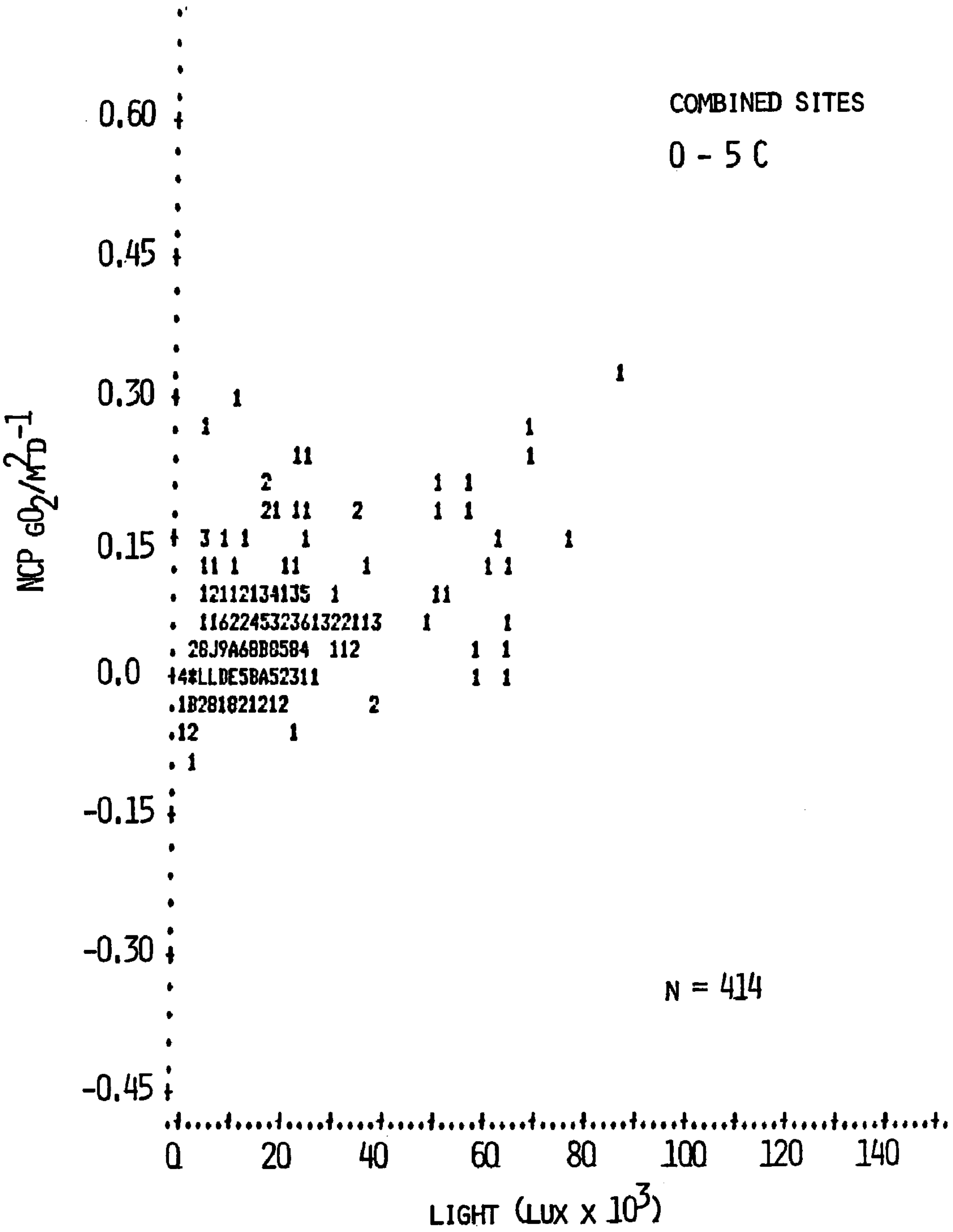

Figure F - 7. Net community productivity within the 0 - 5 C temperature range for combined sites of Augusta Creek, Michigan (1973 - 1975).

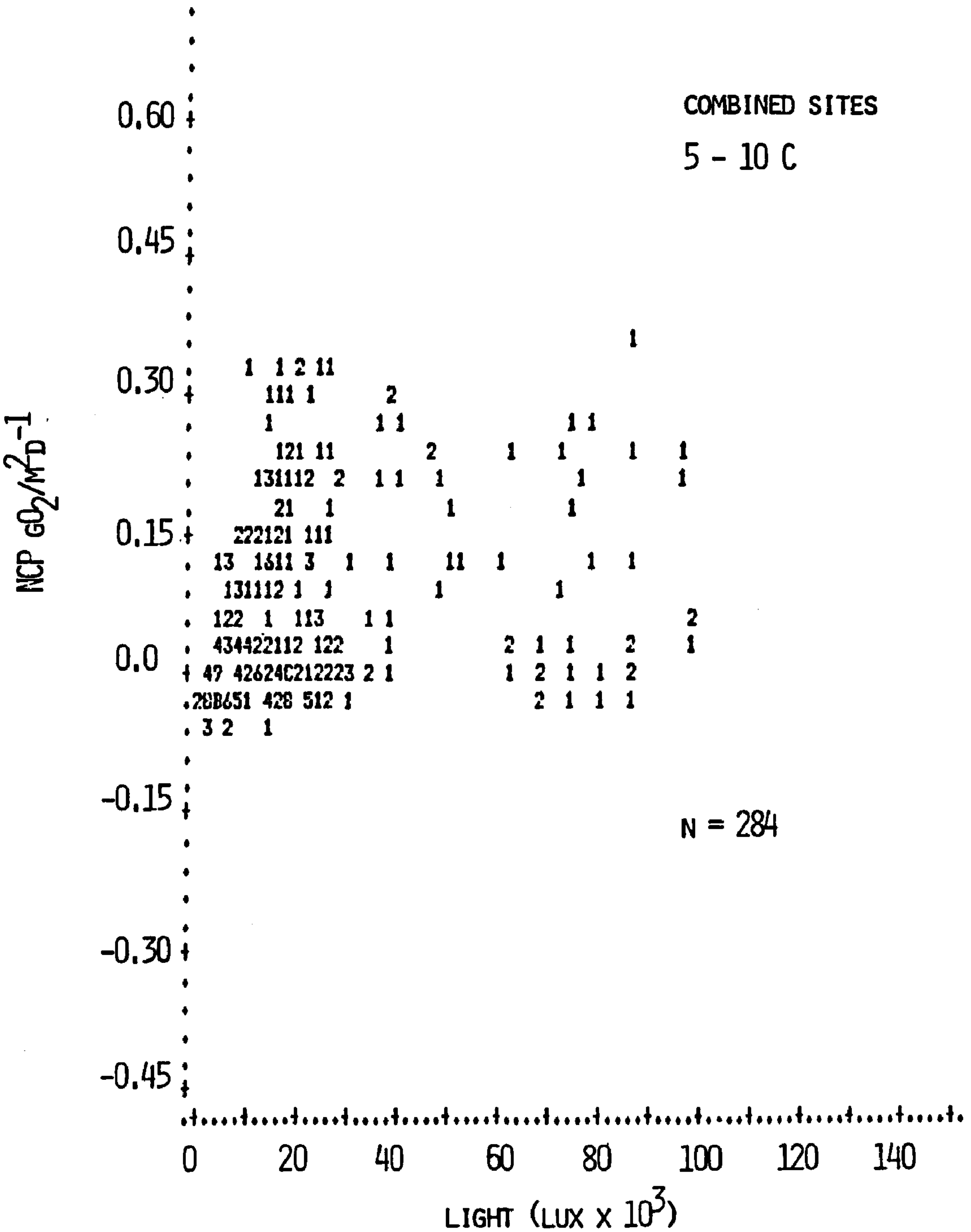

Figure F - 8. Net community productivity within the 5 - 10 C temperature range for combined sites of Augusta Creek, Michigan (1973 - 1975).

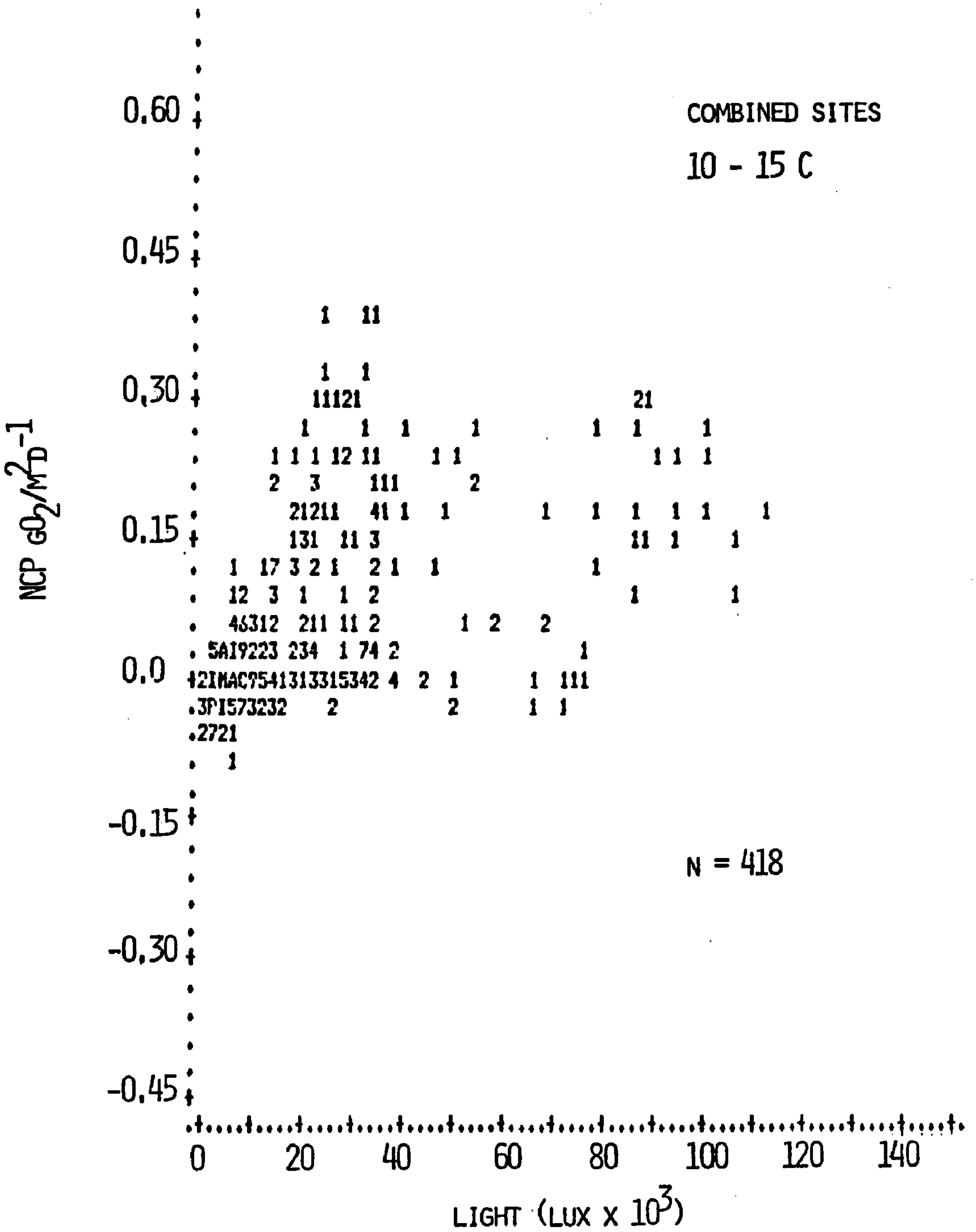

Figure F - 9. Net community productivity within the 10 - 15 C temperature range for combined sites of Augusta Creek, Michigan (1973 - 1975).

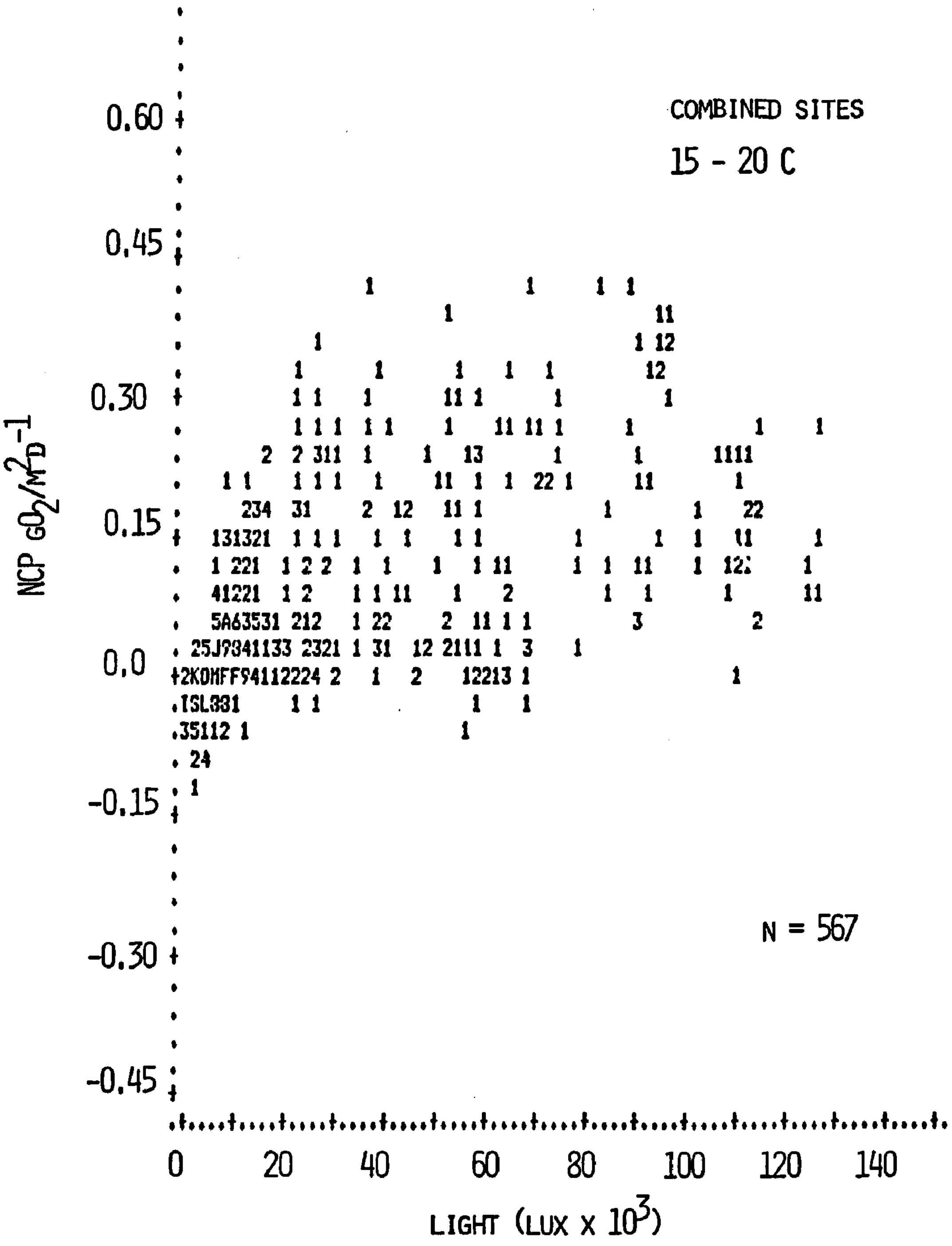

Figure F - 10. Net community productivity within the 15 - 20C temperature range for combined sites of Augusta Creek, Michigan (1973 - 1975).

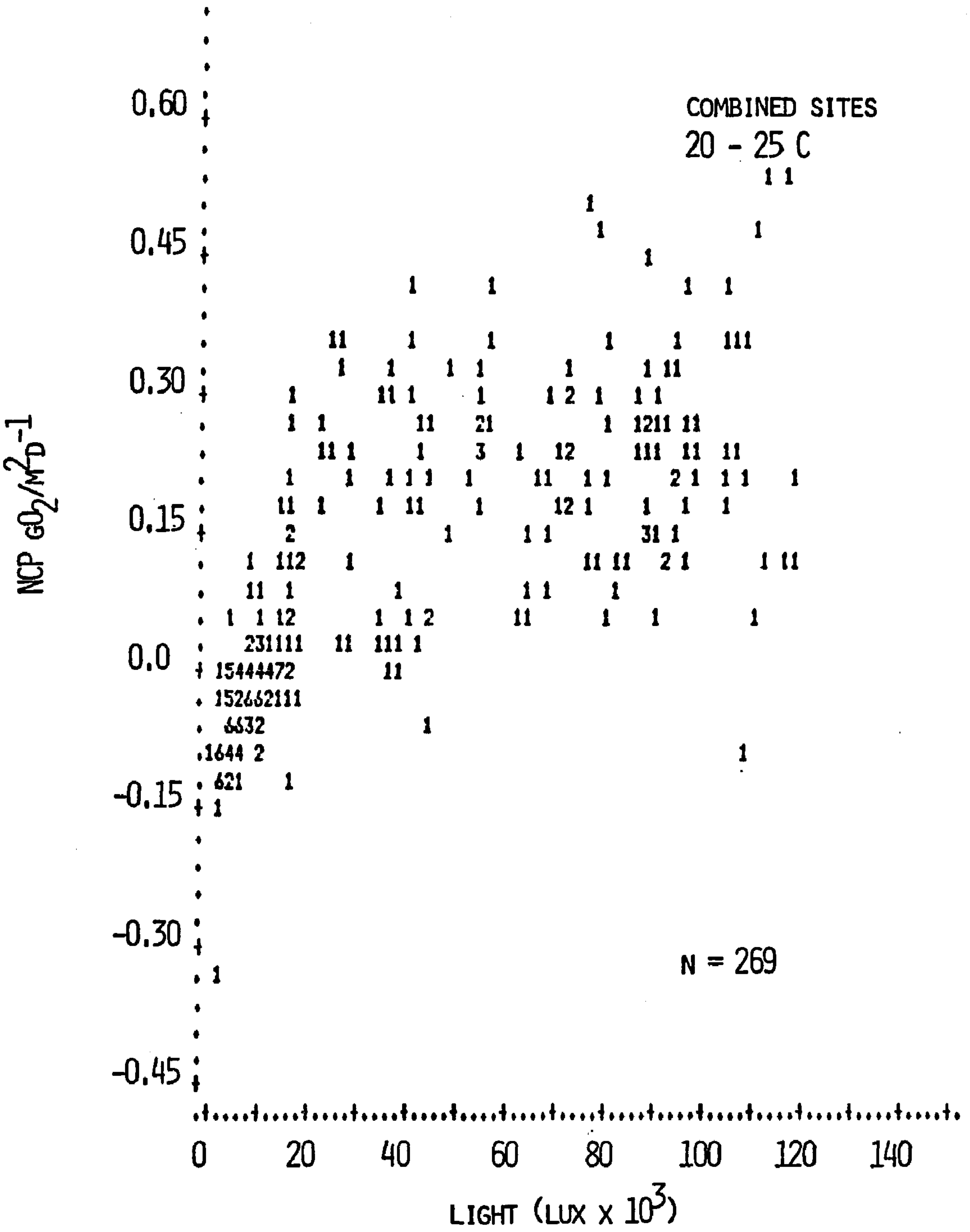

Figure F - 11. Net community productivity within the 20 - 25 C temperature range for combined sites of Augusta Creek, Michigan (1973 - 1975).

APPENDIX G

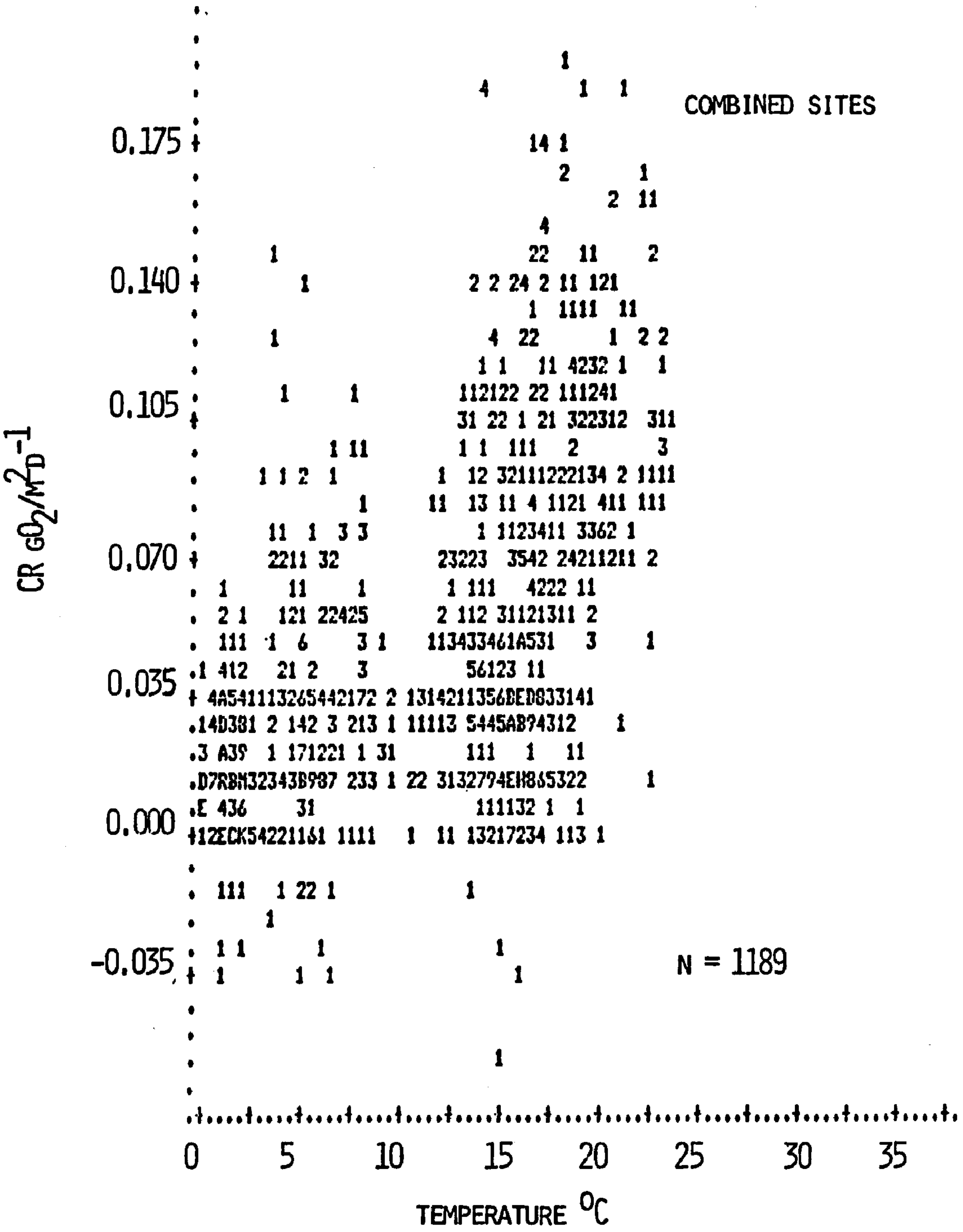

Figure G - 1. Rates of community respiration at various temperatures for combined sites of Augusta Creek, Michigan (1973 - 1975).

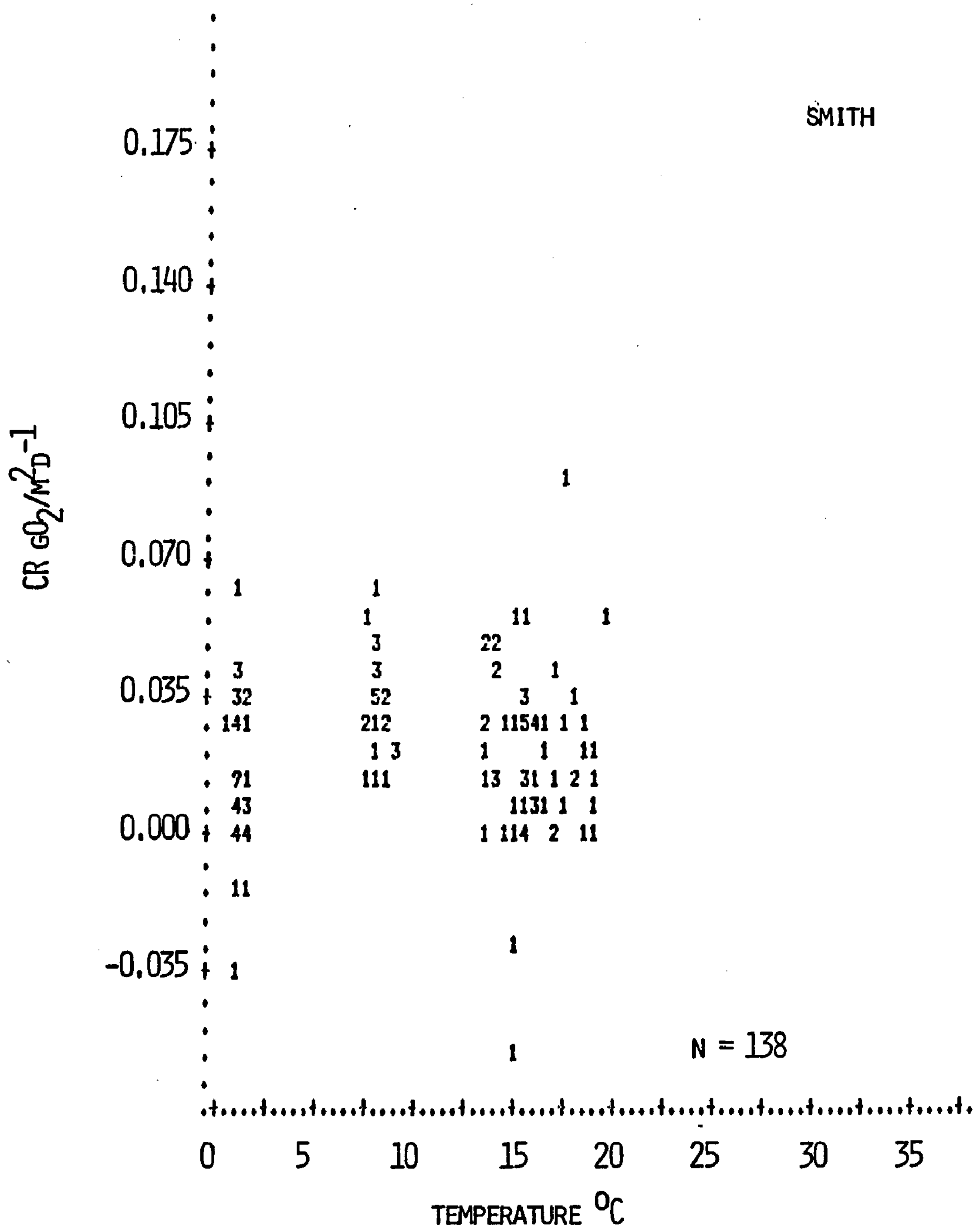

Figure G - 2. Rates of community respiration at various temperatures for Smith site, Augusta Creek, Michigan (1974 - 1975).

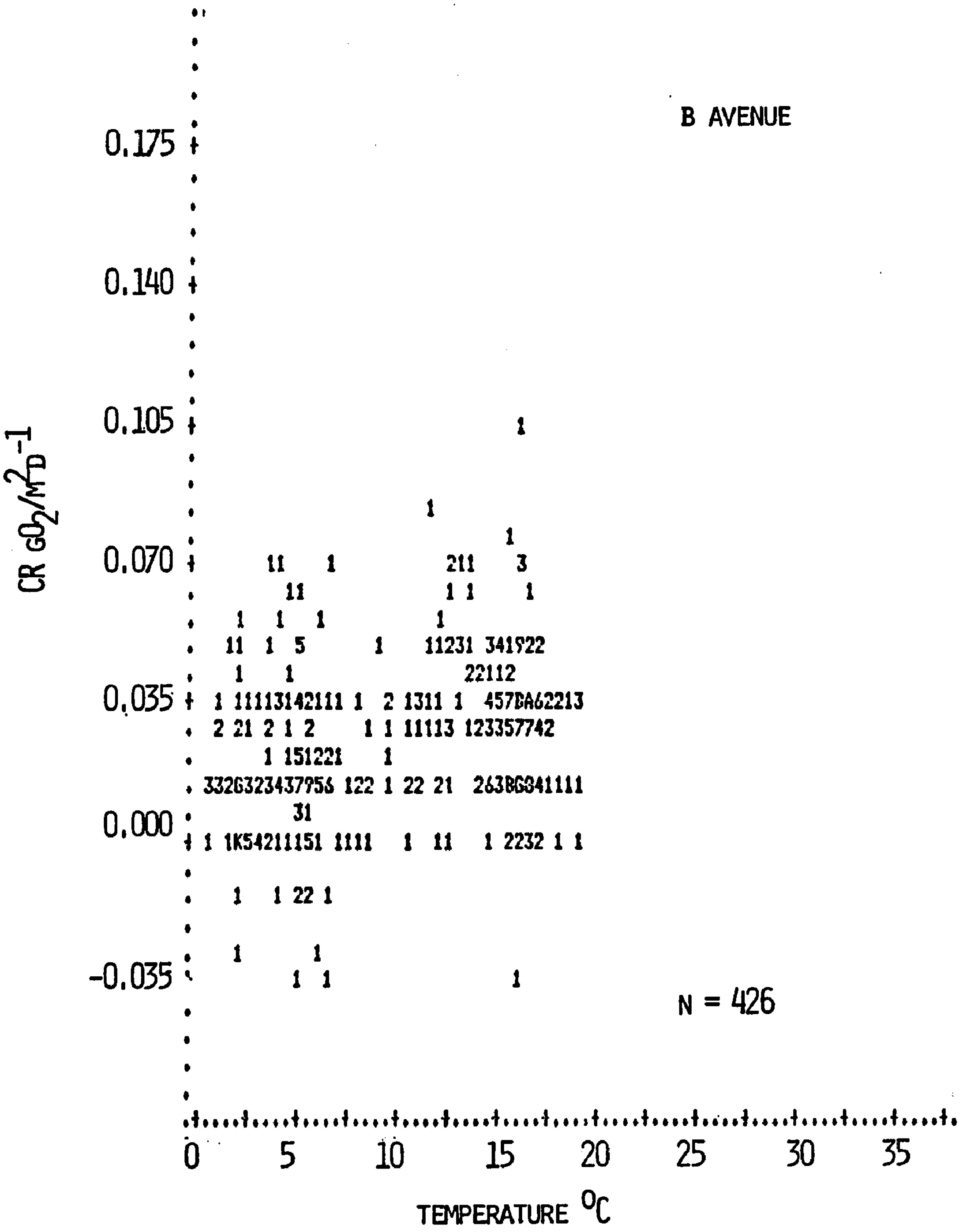

Figure G - 3. Rates of community respiration at various temperatures for B Avenue site, Augusta Creek, Michigan (1973 - 1975).

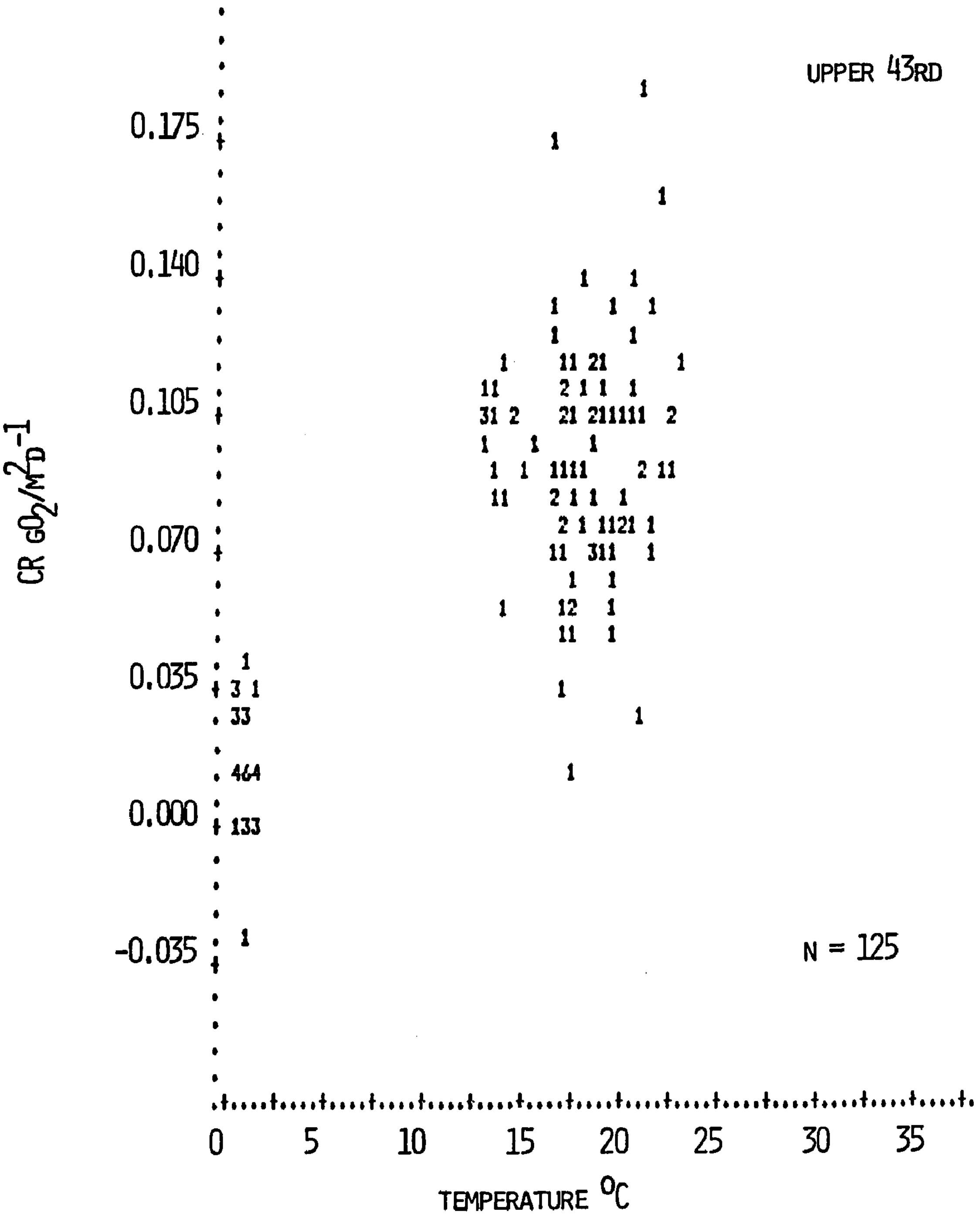

Figure G - 4. Rates of community respiration at various temperatures for Upper 43rd site, Augusta Creek, Michigan (1974 - 1975).

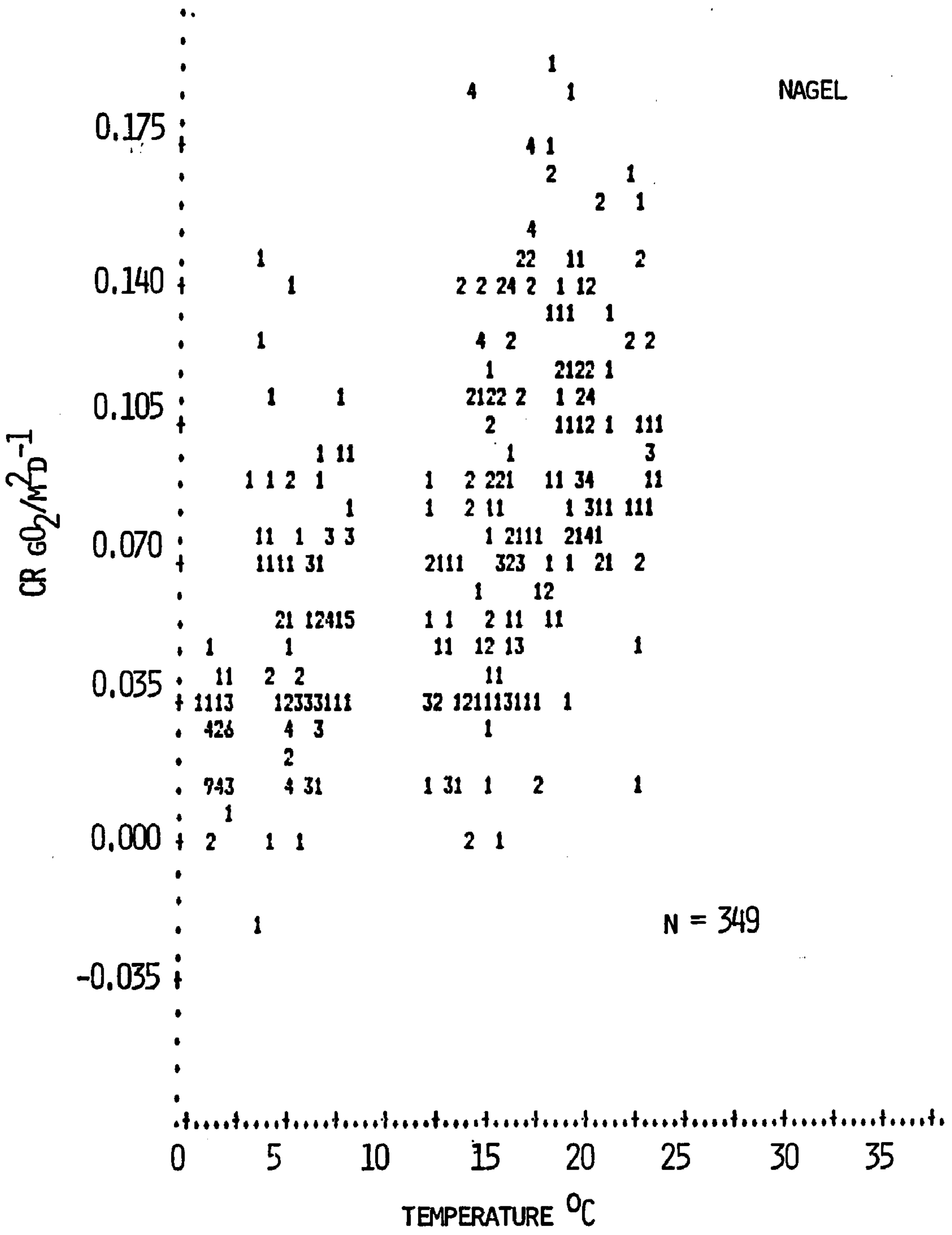

Figure G - 5. Rates of community respiration at various temperatures for Nagel site, Augusta Creek, Michigan (1973 - 1975).

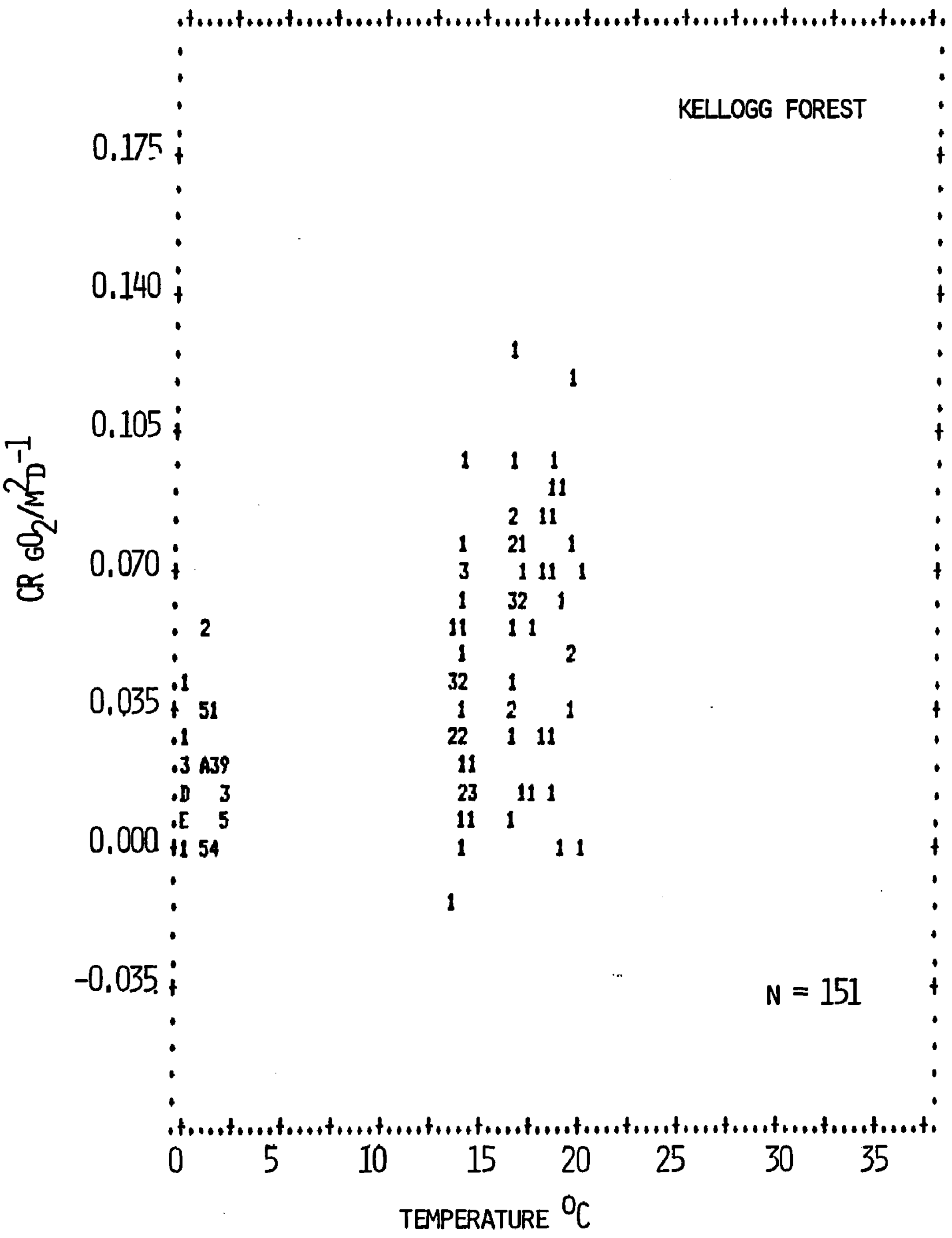

Figure G - 6. Rates of community respiration at various temperatures for Kellogg Forest site, Augusta Creek, Michigan (1973 - 1975).

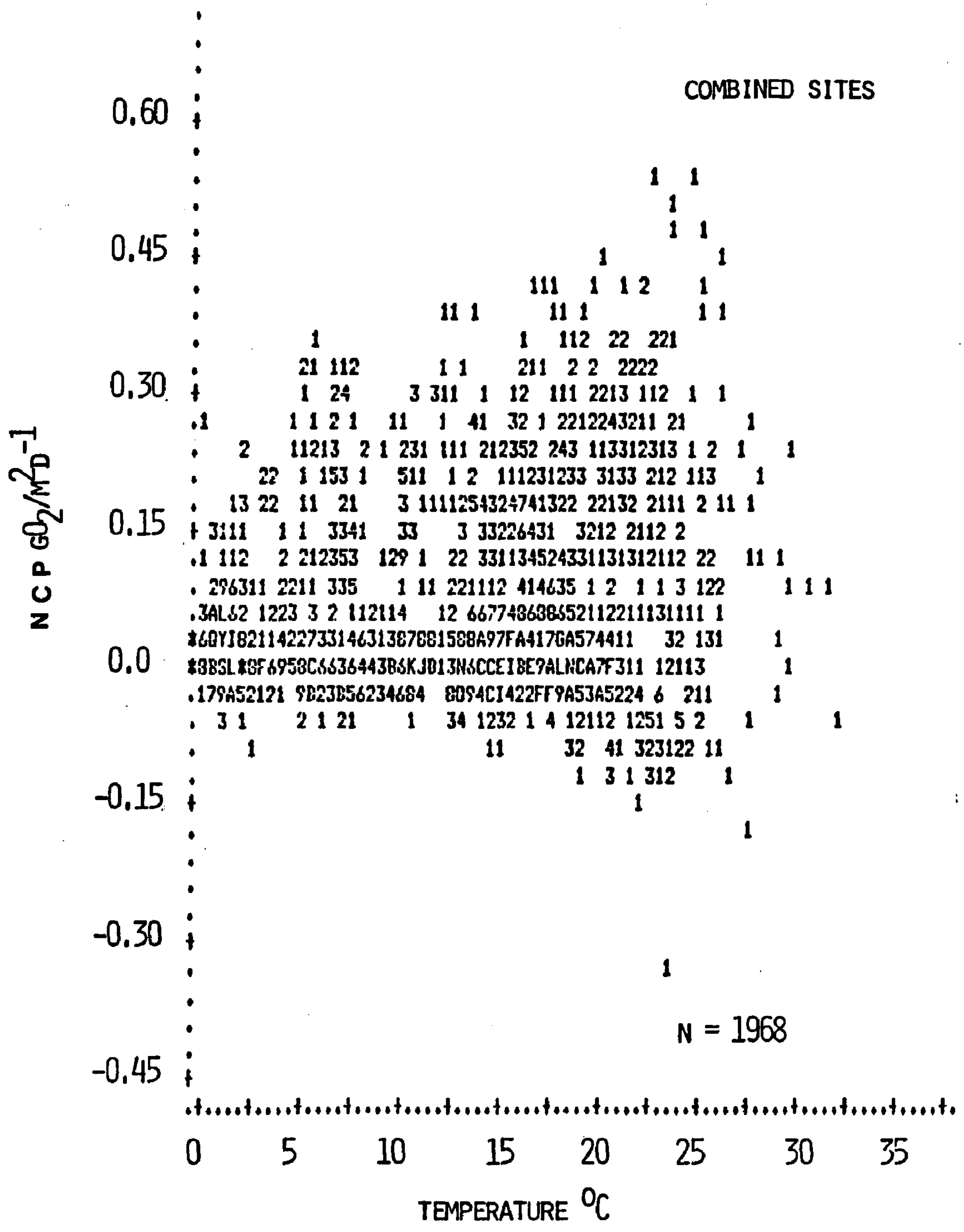

Table G - 7. Net community productivity at various temperatures for combined sites of Augusta Creek, Michigan (1973 - 1975).

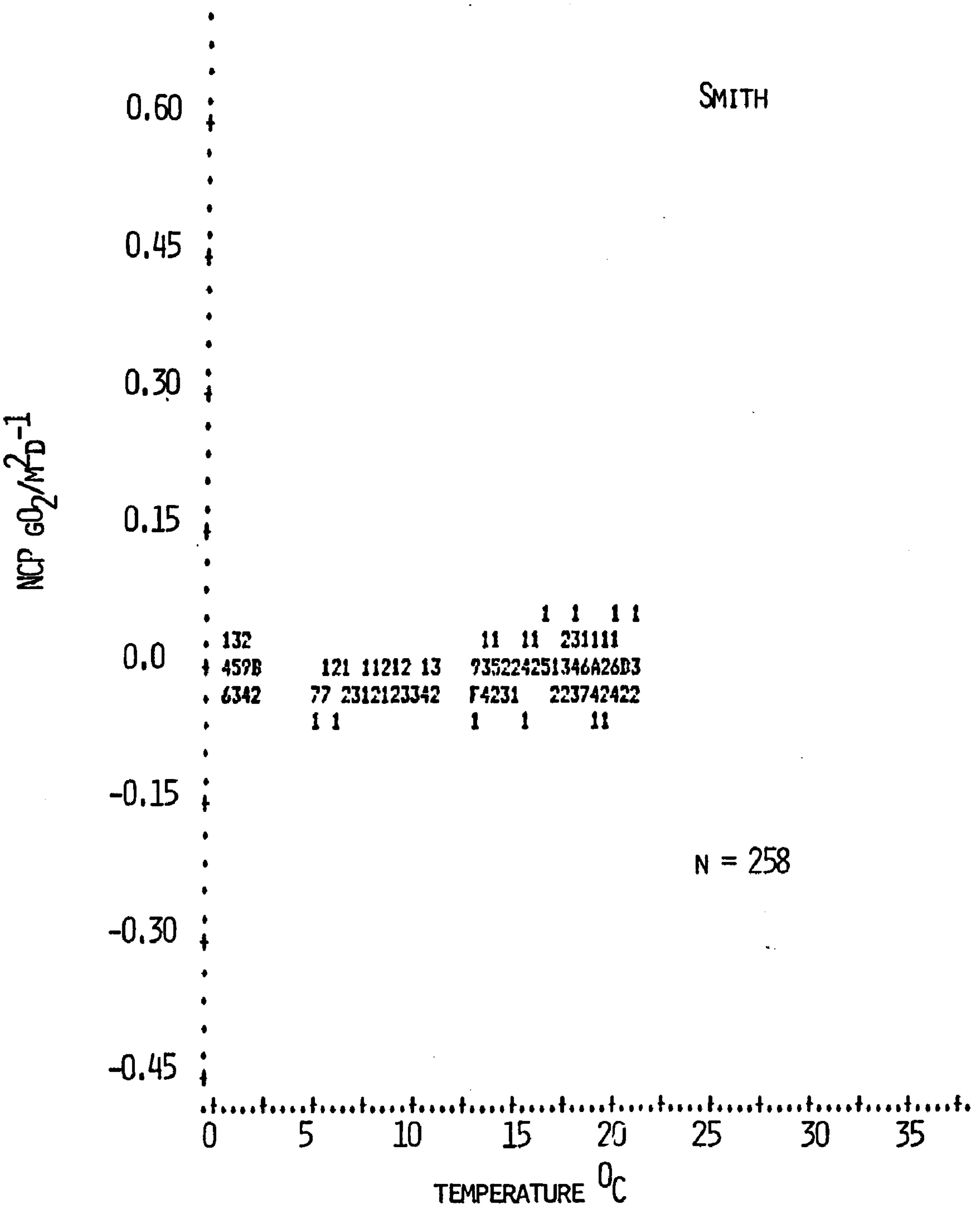

Figure G - 8. Net community productivity at various temperatures for Smith site of Augusta Creek, Michigan (1974 - 1975).

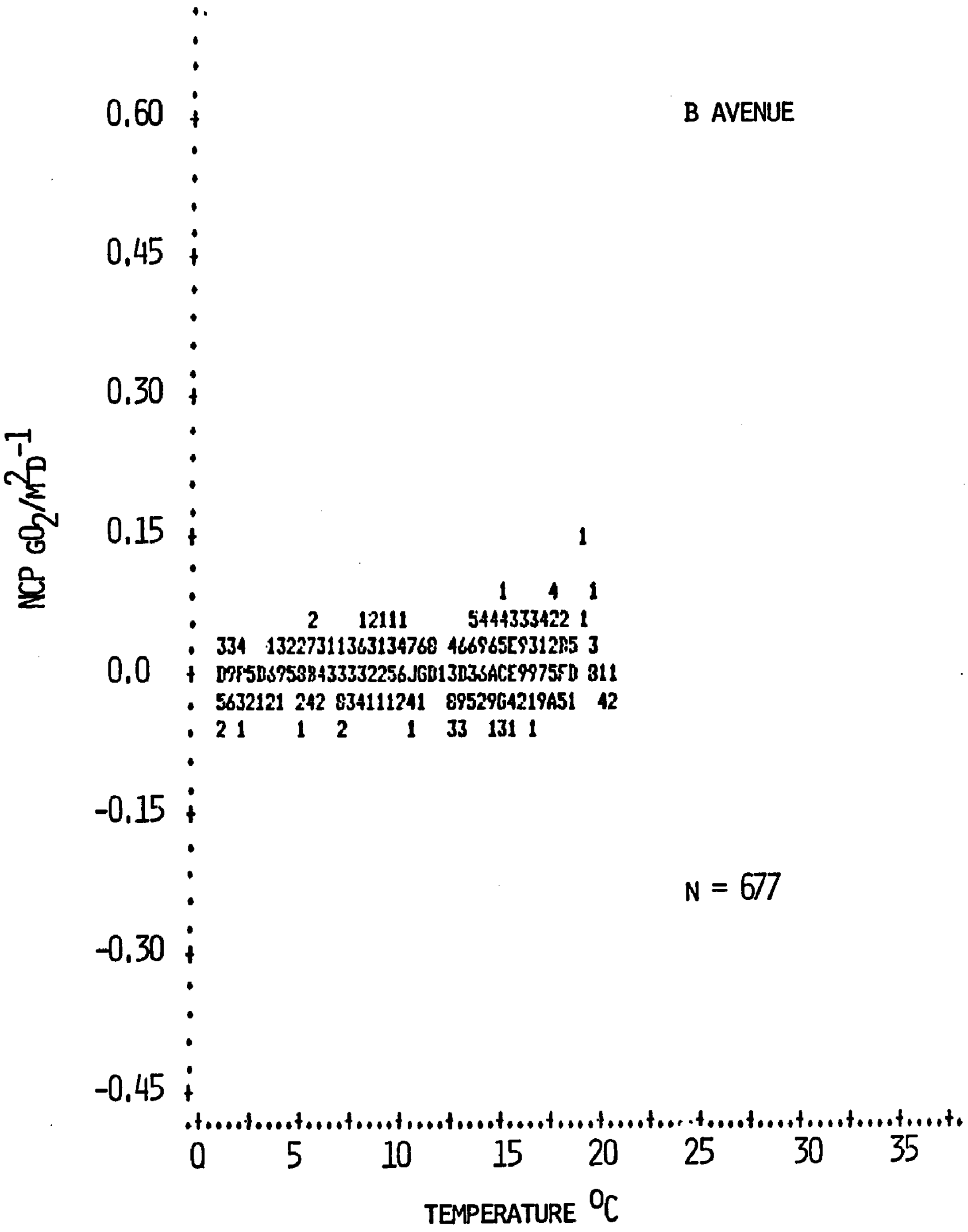

Figure G - 9. Net community productivity at various temperatures for B Avenue site of Augusta Creek, Michigan (1973 - 1975).

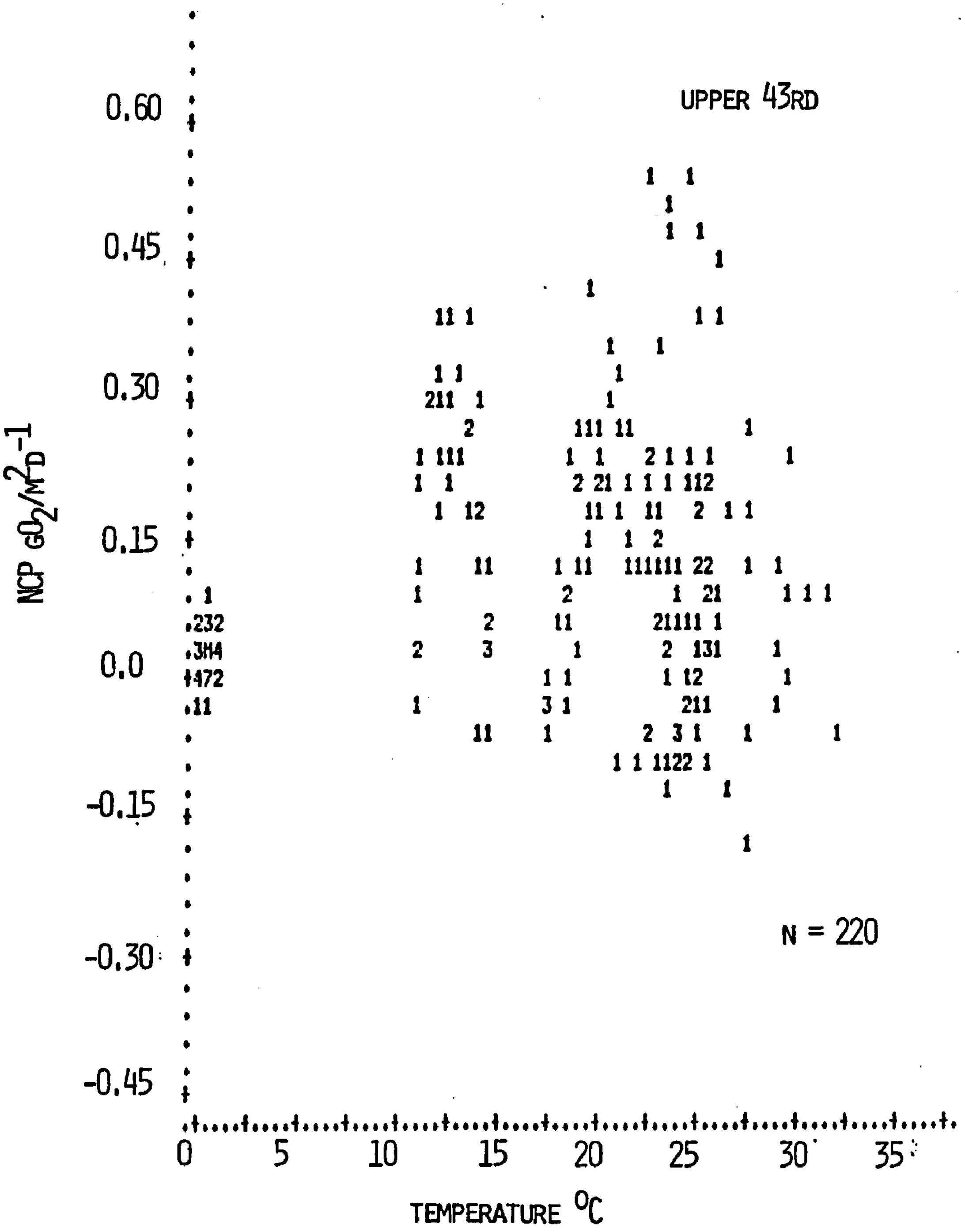

Figure G - 10. Net community productivity at various temperatures for Upper 43rd site of Augusta Creek, Michigan (1974 - 1975).

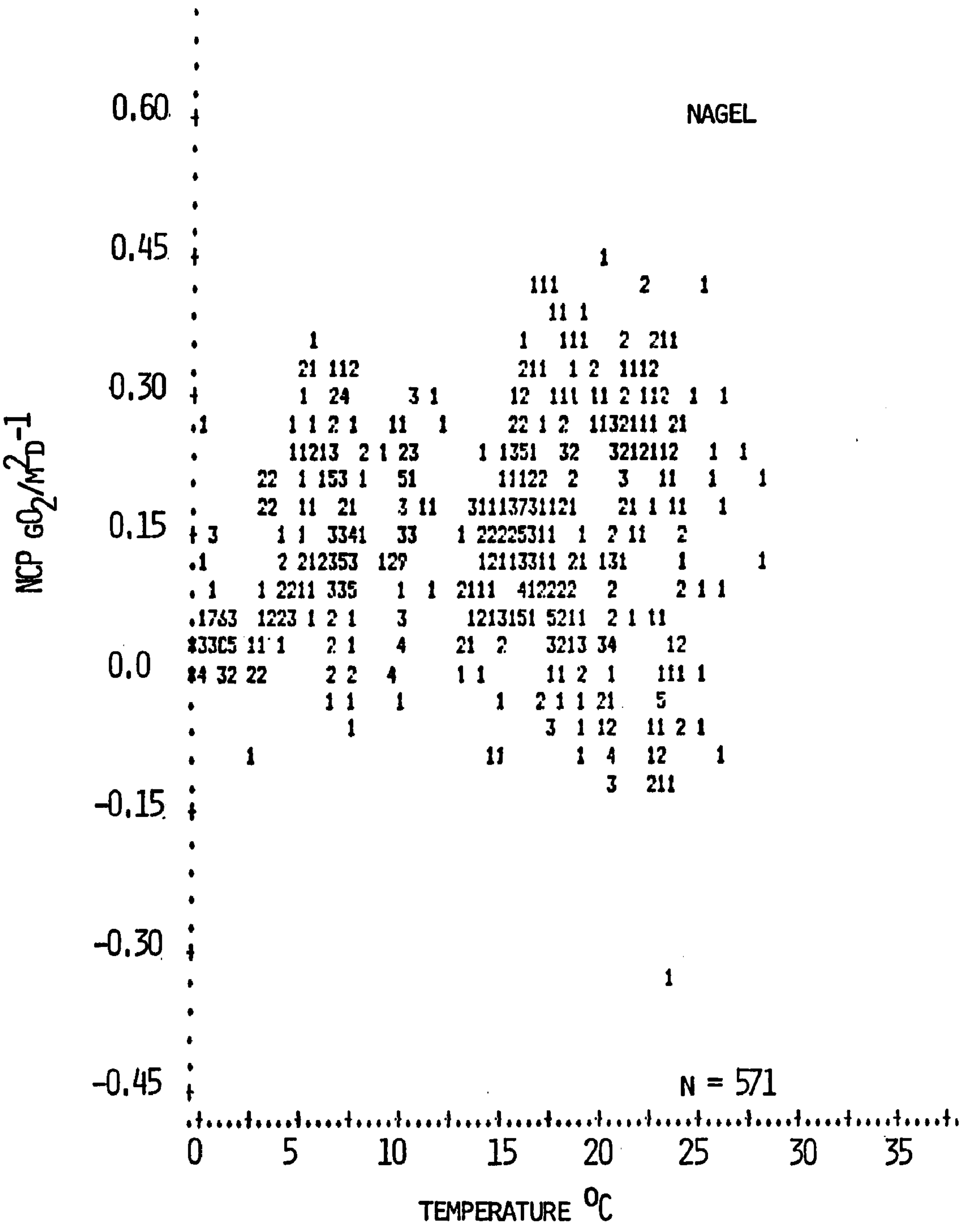

Figure G - 11. Net community productivity at various temperatures for Nagel site of Augusta Creek, Michigan (1973 - 1975).

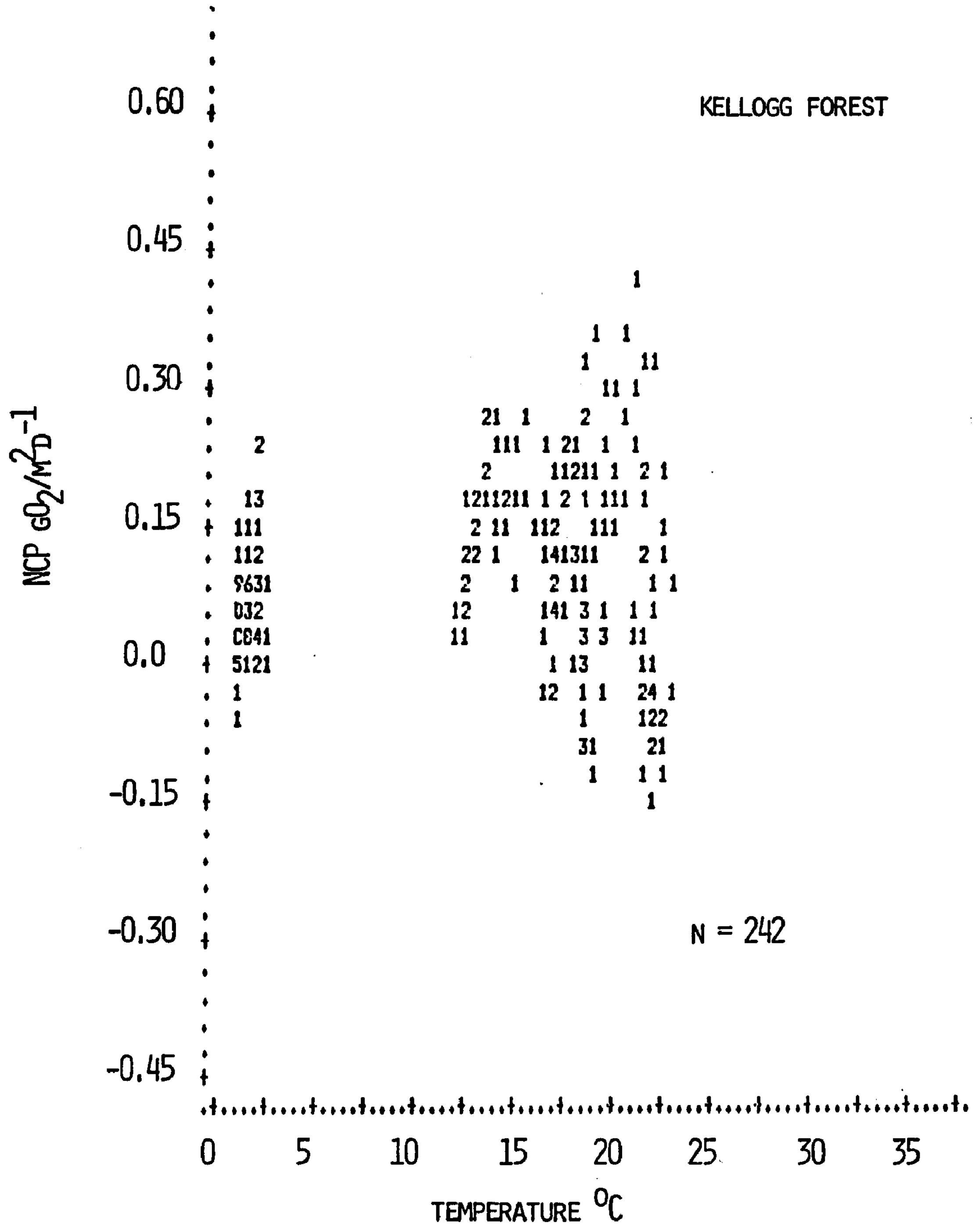

Figure G -12. Net community productivity at various temperatures for Kellogg Forest site of Augusta Creek, Michigan (1974 - 1975).

APPENDIX H

NCP = NET COMMUNITY PRODUCTIVITY

GCP = GROSS COMMUNITY PRODUCTIVITY

CR = COMMUNITY RESPIRATION

NDM = NET DAILY METABOLISM

Table H - 1. Estimates of mean hourly rates of community metabolism based on Gilson Respirometery from five riffle sites of Augusta Creek, Michigan.

SITE: SMITH DATE: 26 **February** 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $UlO_2/G^{-1}H^{-1}$	CR $\bar{X}$ $UlO_2/G^{-1}H^{-1}$
DETRITUS	4 mm	9.06	- - 27.8000	28.5000
DETRITUS	1 mm	16.76	- 57.1000	40.4000
DETRITUS	250 µm	28.11	- 118.5000	33.0000
DETRITUS	75 µm	31.77	- 70.5000	27.3000
DETRITUS	0.45 µm	145.04	- 128.3000	37.3000
EPILITHON	4 mm	1883.83	7.5000	8.7000
EPILITHON	1 mm	426.76	- 19.3000	1.6000
EPILITHON	250 µm	95.40	- 102.4000	0.0000
EPILITHON	75 µm	13.67	- 116.8000	20.2000
COMBINED	4 mm	1892.89	7.3310	8.7948
COMBINED	1 mm	443.51	- 20.7283	3.0661
COMBINED	250 µm	123.51	- 106.0640	7.5108
COMBINED	75 µm	45.44	- 84.4321	25.1635
DETRITUS	0.45 µm	145.04	- 128.3000	37.3000
DETRITUS	TOTAL	230.74	- 110.030	35.2788
EPILITHON	TOTAL	2419.66	- 2.2622	7.1697
COMBINED	TOTAL	2650.40	- 11.6443	9.6169

Table H - 1 (cont.).

SITE: SMITH DATE: 09 June 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $U10_2/G^{-1}H^{-1}$	CR $\bar{X}$ $U10_2/G^{-1}H^{-1}$
DETRITUS	4 mm	10.30	-110.8000	92.8000
DETRITUS	1 mm	38.67	-113.8000	72.6000
DETRITUS	250 µm	71.71	- 68.7000	42.1000
DETRITUS	75 µm	62.93	- 73.2000	46.7000
DETRITUS	0.45 µm	136.65	-128.6000	87.9000
EPILITHON	4 mm	1036.36	- 6.3000	4.2000
EPILITHON	1 mm	321.18	- 11.8000	19.1000
EPILITHON	250 µm	96.35	- 78.8000	43.2000
EPILITHON	75 µm	15.39	- 27.3000	87.6000
COMBINED	4 mm	1046.67	- 7.3287	5.0722
COMBINED	1 mm	359.85	- 22.7608	24.8490
COMBINED	250 µm	168.06	- 74.4905	42.7307
COMBINED	75 µm	78.32	- 64.1803	54.7372
DETRITUS	0.45 µm	136.65	-128.6000	87.9000
DETRITUS	TOTAL	320.27	-101.943	67.8598
EPILITHON	TOTAL	1469.29	- 12.4767	10.8883
COMBINED	TOTAL	1789.55	- 28.4880	21.0842

Table H - 1 (cont.).

SITE: SMITH DATE: 13 August 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $U10_2/G^{-1}H^{-1}$	CR $\bar{X}$ $U10_2/G^{-1}H^{-1}$
DETRITUS	4 mm	17.20	-263.1000	108.4000
DETRITUS	1 mm	20.48	-114.6000	88.6000
DETRITUS	250 µm	20.45	- 49.7000	51.3000
DETRITUS	75 µm	12.56	-205.1000	114.9000
DETRITUS	0.45 µm	124.74	-220.7000	156.5000
EPILITHON	4 mm	1523.54	- 2.6000	17.7000
EPILITHON	1 mm	297.01	- 25.1000	15.8000
EPILITHON	250 µm	86.81	-189.1000	147.2000
EPILITHON	75 µm	7.63	-321.0000	159.0000
COMBINED	4 mm	1540.74	- 5.5087	18.7127
COMBINED	1 mm	317.49	- 30.8730	20.4958
COMBINED	250 µm	107.26	-162.5260	128.9184
COMBINED	75 µm	20.19	-248.9050	131.5677
DETRITUS	0.45 µm	124.74	-220.7000	156.5000
DETRITUS	TOTAL	195.43	-194.4210	131.4702
EPILITHON	TOTAL	1915.00	- 15.8134	23.8392
COMBINED	TOTAL	2110.43	- 32.3531	33.8062

Table H - 1 (cont.).

SITE: B AVENUE DATE: 24 February 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ U1O$_2$/G^{-1}H^{-1}	CR $\bar{X}$ U1O$_2$/G^{-1}H^{-1}
DETRITUS	4 mm	10.02	- 42.9000	45.9000
DETRITUS	1 mm	27.03	- 88.7000	41.7000
DETRITUS	250 µm	26.71	- 85.5000	26.8000
DETRITUS	75 µm	30.56	-108.9000	39.8000
DETRITUS	0.45 µm	82.45	-160.8000	69.4000
EPILITHON	4 mm	1824.18	4.4000	4.5000
EPILITHON	1 mm	428.22	- 8.8000	1.7000
EPILITHON	250 µm	258.28	3.9000	3.7000
EPILITHON	75 µm	11.29	- 97.4000	4.7000
COMBINED	4 mm	1834.19	4.1417	4.7261
COMBINED	1 mm	455.25	- 13.5440	4.0750
COMBINED	250 µm	284.99	- 4.4794	5.8651
COMBINED	75 µm	41.85	-105.798	30.3315
DETRITUS	0.45 µm	82.45	-160.8000	69.4000
DETRITUS	TOTAL	176.77	-122.742	52.2778
EPILITHON	TOTAL	2521.96	1.6518	3.9435
COMBINED	TOTAL	2698.73	- 6.4960	7.1094

Table H - 1 (cont.).

SITE: B AVENUE DATE: 02 June 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $U1O_2/G^{-1}H^{-2}$	CR $\bar{X}$ $U1O_2/G^{-1}H^{-1}$
DETRITUS	4 mm	72.15	- 43.8000	41.2000
DETRITUS	1 mm	125.67	- 75.9000	56.5000
DETRITUS	250 µm	94.67	- 68.2000	52.0000
DETRITUS	75 µm	100.23	- 90.1000	78.2000
DETRITUS	0.45 µm	109.44	-159.5000	153.0000
EPILITHON	4 mm	2541.46	- 7.6000	19.5000
EPILITHON	1 mm	284.29	- 15.0000	21.9000
EPILITHON	250 µm	125.29	-110.6000	125.0000
EPILITHON	75 µm	9.20	-128.8000	162.9000
COMBINED	4 mm	2613.61	- 8.5994	20.0991
COMBINED	1 mm	409.97	- 33.9461	32.5065
COMBINED	250 µm	219.96	- 92.3515	93.5816
COMBINED	75 µm	109.44	- 93.3544	85.3227
DETRITUS	0.45 µm	109.44	-159.5000	153.0000
DETRITUS	TOTAL	502.17	- 90.8897	78.8152
EPILITHON	TOTAL	2960.24	- 13.0853	24.6416
COMBINED	TOTAL	3462.41	- 24.3697	32.4986

Table H - 1 (cont.).

SITE: B AVENUE DATE: 11 August 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ U10$_2$/G^{-1}H^{-1}	CR $\bar{X}$ U10$_2$/G^{-1}H^{-1}
DETRITUS	4 mm	26.49	-108.8000	78.2000
DETRITUS	1 mm	113.27	-108.7000	93.7000
DETRITUS	250 μm	72.69	-245.4000	206.0000
DETRITUS	75 μm	64.14	-191.4000	117.5000
DETRITUS	0.45 μm	107.17	-319.7000	259.6000
EPILITHON	4 mm	2586.29	- 21.7000	34.0000
EPILITHON	1 mm	237.55	- 52.4000	56.9000
EPILITHON	250 μm	149.14	- 77.5000	96.1000
EPILITHON	75 μm	11.77	- 62.7000	144.3000
COMBINED	4 mm	2612.78	- 22.5830	34.4481
COMBINED	1 mm	350.82	- 70.5781	68.7819
COMBINED	250 μm	221.84	-132.5200	132.1137
COMBINED	75 μm	75.91	-171.4510	121.6542
DETRITUS	0.45 μm	107.17	-319.7000	259.6000
DETRITUS	TOTAL	383.76	-207.346	164.2083
EPILITHON	TOTAL	2984.75	- 27.0931	39.3604
COMBINED	TOTAL	3368.51	- 47.6287	53.5838

Table H - 1 (cont.)

SITE: UPPER 43RD DATE: 28 February 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $U10_2/G^{-1}H^{-1}$	CR $\bar{X}$ $U10_2/G^{-1}H^{-1}$
DETRITUS	4 mm	8.55	- 33.2000	78.6000
DETRITUS	1 mm	11.58	10.2000	43.8000
DETRITUS	250 µm	34.82	- 32.4000	38.3000
DETRITUS	75 µm	31.23	- 52.2000	35.1000
DETRITUS	0.45 µm	67.65	- 39.7000	77.4000
EPILITHON	4 mm	4334.02	177.3000	1.9000
EPILITHON	1 mm	354.25	59.4000	4.6000
EPILITHON	250 µm	67.73	169.9000	0.0000
EPILITHON	75 µm	5.72	404.2000	0.0000
COMBINED	4 mm	4342.58	176.8853	2.0511
COMBINED	1 mm	365.83	57.8433	5.8403
COMBINED	250 µm	102.56	101.2121	13.0042
COMBINED	75 µm	36.95	18.4988	29.6628
DETRITUS	0.45 µm	67.65	- 39.7000	77.4000
DETRITUS	TOTAL	153.83	- 36.4687	57.5003
EPILITHON	TOTAL	4761.73	168.6963	2.0716
COMBINED	TOTAL	4915.56	162.2759	3.8061

Table H - 1 (cont.).

SITE: UPPER 43RD DATE: 12 June 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ U10$_2$/G^{-1}H^{-1}	CR $\bar{X}$ U10$_2$/G^{-1}H^{-1}
DETRITUS	4 mm	30.97	-130.7000	127.7000
DETRITUS	1 mm	23.12	-105.8000	172.7000
DETRITUS	250 µm	10.43	- 28.2000	199.5000
DETRITUS	75 µm	16.43	- 49.4000	257.5000
DETRITUS	0.45 µm	32.53	1687.6000	738.8000
EPILITHON	4 mm	1162.61	72.8000	72.8000
EPILITHON	1 mm	27.03	111.1000	111.1000
EPILITHON	250 µm	27.03	205.9000	205.9000
EPILITHON	75 µm	2.23	211.0000	211.0000
COMBINED	4 mm	1193.58	131.6118	74.2247
COMBINED	1 mm	50.15	29.4885	139.4977
COMBINED	250 µm	37.46	265.9547	204.1180
COMBINED	75 µm	18.25	32.6975	251.8292
DETRITUS	0.45 µm	32.53	1687.6000	738.8000
DETRITUS	TOTAL	113.08	423.6638	337.7225
EPILITHON	TOTAL	1218.89	144.4912	76.8533
COMBINED	TOTAL	1331.98	168.1921	99.0004

Table H - 1 (cont.).

SITE: UPPER 43RD DATE: 15 August 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $U10_2/G^{-1}H^{-1}$	CR $\bar{X}$ $U10_2/G^{-1}H^{-1}$
DETRITUS	4 mm	6.17	-101.9000	214.9000
DETRITUS	1 mm	20.00	-154.8000	119.1000
DETRITUS	250 µm	32.50	-145.7000	139.3000
DETRITUS	75 µm	71.61	24.7000	96.6000
DETRITUS	0.45 µm	81.31	-191.9000	236.8000
EPILITHON	4 mm	4676.19	33.1000	12.3000
EPILITHON	1 mm	222.92	20.7000	13.4000
EPILITHON	250 µm	19.40	117.7000	44.1000
EPILITHON	75 µm	7.31	130.1000	119.9000
COMBINED	4 mm	4682.36	32.9221	12.5669
COMBINED	1 mm	242.92	6.2492	22.1034
COMBINED	250 µm	51.90	- 47.2478	103.7167
COMBINED	75 µm	78.93	34.4671	98.7591
DETRITUS	0.45 µm	81.31	-191.9000	236.8000
DETRITUS	TOTAL	211.60	-105.366	162.6104
EPILITHON	TOTAL	4925.82	33.0160	12.6348
COMBINED	TOTAL	5137.42	27.3164	18.8119

Table H - 1 (cont.).

SITE: NAGEL DATE: 03 March 1975

SEDIMENT TYPE	PARITCLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $U10_2/G^{-1}H^{-1}$	CR $\bar{X}$ $U10_2/G^{-1}H^{-1}$
DETRITUS	4 mm	27.03	- 6.0000	15.1000
DETRITUS	1 mm	25.15	- 43.8000	19.8000
DETRITUS	250 μm	29.13	- 38.0000	16.2000
DETRITUS	75 μm	30.37	- 49.4000	20.5000
DETRITUS	0.45 μm	75.46	- 52.1000	28.9000
EPILITHON	4 mm	7098.30	22.4000	1.4000
EPILITHON	1 mm	273.67	11.5000	0.2000
EPILITHON	250 μm	289.63	152.1000	0.0000
EPILITHON	75 μm	3.24	193.4000	0.9000
COMBINED	4 mm	7125.33	22.2923	1.4520
COMBINED	1 mm	298.82	6.8451	1.8498
COMBINED	250 μm	318.76	134.7285	1.4804
COMBINED	75 μm	33.61	- 25.9699	18.6086
DETRITUS	0.45 μm	75.46	- 52.1000	28.9000
DETRITUS	TOTAL	187.14	- 41.6931	22.3438
EPILITHON	TOTAL	7664.85	26.9842	1.3040
COMBINED	TOTAL	7851.99	25.3474	1.8055

Table H - 1 (cont.).

SITE: NAGEL DATE: 04 June 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $U10_2/G^{-1}H^{-1}$	CR $\bar{X}$ $U10_2/G^{-1}H^{-1}$
DETRITUS	4 mm	35.17	- 51.9000	44.2000
DETRITUS	1 mm	20.64	- 69.9000	48.5000
DETRITUS	250 µm	32.18	- 85.7000	57.0000
DETRITUS	75 µm	10.53	-124.5000	103.2000
DETRITUS	0.45 µm	85.89	-159.6000	225.1000
EPILITHON	4 mm	4442.46	26.4000	28.9000
EPILITHON	1 mm	442.02	59.3000	32.9000
EPILITHON	250 µm	167.90	153.6000	96.7000
EPILITHON	75 µm	10.53	211.4000	137.8000
COMBINED	4 mm	4477.63	25.7850	29.0202
COMBINED	1 mm	462.66	53.5367	33.5959
COMBINED	250 µm	200.09	115.1112	90.3147
COMBINED	75 µm	20.86	44.9861	120.6582
DETRITUS	0.45 µm	85.89	-159.6000	225.1000
DETRITUS	TOTAL	184.22	-114.1100	143.5729
EPILITHON	TOTAL	5062.91	33.8754	31.7241
COMBINED	TOTAL	5247.13	28.6799	35.3349

Table H - 1 (cont.).

SITE: NAGEL DATE: 18 August 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $U10_2/G^{-1}H^{-1}$	CR $\bar{X}$ $U10_2/G^{-1}H^{-1}$
DETRITUS	4 mm	9.86	- 11.4000	43.6000
DETRITUS	1 mm	35.49	- 7.1000	34.0000
DETRITUS	250 µm	28.33	- 39.0000	52.8000
DETRITUS	75 µm	34.63	-110.4000	90.7000
DETRITUS	0.45 µm	69.83	- 40.0000	218.8000
EPILITHON	4 mm	3491.64	58.5000	24.9000
EPILITHON	1 mm	181.26	- 10.7000	39.7000
EPILITHON	250 µm	43.25	14.3000	49.7000
EPILITHON	75 µm	5.72	212.6000	241.9000
COMBINED	4 mm	3501.50	58.3032	24.9527
COMBINED	1 mm	216.75	- 10.1106	38.7667
COMBINED	250 µm	71.58	- 6.7974	50.9271
COMBINED	75 µm	40.35	- 64.5844	112.1468
DETRITUS	0.45 µm	69.83	- 40.0000	218.8000
DETRITUS	TOTAL	178.14	- 45.3895	120.9857
EPILITHON	TOTAL	3721.87	54.8533	26.2427
COMBINED	TOTAL	3900.02	50.2744	30.5703

Table H - 1 (cont.).

SITE: KELLOGG FOREST DATE: 05 March 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $UlO_2/G^{-1}H^{-1}$	CR $\bar{X}$ $UlO_2/G^{-1}H^{-1}$
DETRITUS	4 mm	8.01	- 1.3000	93.7000
DETRITUS	1 mm	21.37	- 33.8000	104.2000
DETRITUS	250 µm	43.50	- 28.0000	41.5000
DETRITUS	75 µm	55.94	- 47.1000	71.0000
DETRITUS	0.45 µm	116.60	- 47.2000	142.7000
EPILITHON	4 mm	2174.17	57.3000	22.2000
EPILITHON	1 mm	120.08	50.5000	34.3000
EPILITHON	250 µm	31.48	111.5000	28.5000
EPILITHON	75 µm	3.18	- 50.0000	34.0000
COMBINED	4 mm	2182.18	57.0848	22.4626
COMBINED	1 mm	141.45	37.7640	44.8604
COMBINED	250 µm	74.98	30.5687	36.0420
COMBINED	75 µm	59.12	- 47.2560	69.0097
DETRITUS	0.45 µm	116.60	- 47.2000	142.7000
DETRITUS	TOTAL	245.42	- 41.1084	103.4678
EPILITHON	TOTAL	2328.90	57.5356	22.9251
COMBINED	TOTAL	2574.33	48.1314	30.6037

Table H - 1 (cont.).

SITE: KELLOGG FOREST DATE: 06 June 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ $U10_2/G^{-1}H^{-1}$	CR $\bar{X}$ $U10_2/G^{-1}H^{-1}$
DETRITUS	4 mm	5.98	- 81.8000	65.0000
DETRITUS	1 mm	34.79	- 84.8000	78.7000
DETRITUS	250 µm	52.57	- 63.6000	43.8000
DETRITUS	75 µm	40.55	-117.7000	105.8000
DETRITUS	0.45 µm	61.69	-102.8000	358.8000
EPILITHON	4 mm	1884.47	97.0000	41.6000
EPILITHON	1 mm	154.55	33.9000	36.9000
EPILITHON	250 µm	36.57	333.9000	190.6000
EPILITHON	75 µm	34.41	421.2000	214.5000
COMBINED	4 mm	1890.45	96.4346	41.6740
COMBINED	1 mm	189.34	12.0898	44.5804
COMBINED	250 µm	89.14	99.4842	104.0283
COMBINED	75 µm	74.95	129.6864	155.6996
DETRITUS	0.45 µm	61.69	-102.8000	358.8000
DETRITUS	TOTAL	195.57	- 91.5089	162.8758
EPILITHON	TOTAL	2109.99	101.7708	46.6577
COMBINED	TOTAL	2305.56	85.3758	56.5159

Table H - 1 (cont.).

SITE: KELLOGG FOREST DATE: 20 August 1975

SEDIMENT TYPE	PARTICLE SIZE	AFDW G/M^{-2}	NCP $\bar{X}$ U10$_2$/G^{-1}H^{-1}	CR $\bar{X}$ U10$_2$/G^{-1}H^{-1}
DETRITUS	4 mm	0.95	-239.0000	489.6000
DETRITUS	1 mm	14.21	- 61.6000	189.4000
DETRITUS	250 µm	37.33	- 96.2000	107.5000
DETRITUS	75 µm	25.47	- 94.5000	98.6000
DETRITUS	0.45 µm	78.75	-194.8000	284.5000
EPILITHON	4 mm	3136.43	- 12.5000	19.1000
EPILITHON	1 mm	146.28	17.5000	20.1000
EPILITHON	250 µm	30.21	7.2000	103.7000
EPILITHON	75 µm	10.49	219.5000	147.1000
COMBINED	4 mm	3137.39	- 12.5689	19.2431
COMBINED	1 mm	160.49	10.4943	35.0945
COMBINED	250 µm	67.54	- 49.9480	105.8002
COMBINED	75 µm	35.96	- 2.8658	112.7537
DETRITUS	0.45 µm	78.75	-194.8000	284.5000
DETRITUS	TOTAL	156.71	-143.2020	204.7524
EPILITHON	TOTAL	3323.42	- 10.2679	20.3172

Table H - 2. Areal estimates of community metabolism based on Gilson Respirometery experiments from five riffle sites of Augusta Creek, Michigan .

SITE: SMITH DATE: 26 February 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0032	0.0001	0.0071	0.01	-0.0070
DETRITUS	1 mm	-0.0121	-0.0036	0.0187	-0.19	-0.0222
DETRITUS	250 µm	-0.0423	-0.0305	0.0256	-1.19	-0.0561
DETRITUS	75 µm	-0.0284	-0.0174	0.0239	-0.73	-0.0413
DETRITUS	0.45 µm	-0.2363	-0.1676	0.1492	-1.12	-0.3168
EPILITHON	4 mm	0.1794	0.3875	0.4520	0.86	-0.0645
EPILITHON	1 mm	-0.1046	-0.0959	0.0188	-5.09	-0.1147
EPILITHON	250 µm	-0.1240	-0.1240	0.0000	0.00	-0.1240
EPILITHON	75 µm	-0.0203	-0.0168	0.0076	-2.20	-0.0244
COMBINED	4 mm	0.1762	0.3876	0.4591	0.84	-0.0715
COMBINED	1 mm	-0.1167	-0.0995	0.0375	-2.65	-0.1370
COMBINED	250 µm	-0.1663	-0.1545	0.0256	-6.04	-0.1801
COMBINED	75 µm	-0.0487	-0.0342	0.0315	-1.08	-0.0657
DETRITUS	0.45 µm	-0.2363	-0.1676	0.1492	-1.12	-0.3168
DETRITUS	TOTAL	-0.3223	-0.2190	0.2245	-0.98	-0.4435
EPILITHON	TOTAL	-0.0695	0.1508	0.4784	0.32	-0.3276
COMBINED	TOTAL	-0.3918	-0.0682	0.7029	-0.10	-0.7711

Table H - 2 (cont.).

SITE: SMITH DATE: 09 June 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0199	-0.0032	0.0264	-0.12	-0.0296
DETRITUS	1 mm	-0.0769	-0.0278	0.0774	-0.36	-0.1052
DETRITUS	250 µm	-0.0860	-0.0333	0.0833	-0.40	-0.1166
DETRITUS	75 µm	-0.0805	-0.0291	0.0810	-0.36	-0.1102
DETRITUS	0.45 µm	-0.3069	-0.0971	0.3312	-0.29	-0.4284
EPILITHON	4 mm	-0.1140	-0.0380	0.1200	-0.32	-0.1580
EPILITHON	1 mm	-0.0662	0.0409	0.1692	0.24	-0.1282
EPILITHON	250 µm	-0.1326	-0.0599	0.1148	-0.52	-0.1747
EPILITHON	75 µm	-0.0073	0.0162	0.0372	0.44	-0.0210
COMBINED	4 mm	-0.1340	-0.0412	0.1464	-0.28	-0.1876
COMBINED	1 mm	-0.1430	0.0131	0.2466	0.05	-0.2335
COMBINED	250 µm	-0.2186	-0.0932	0.1980	-0.47	-0.2913
COMBINED	75 µm	-0.0878	-0.0129	0.1182	-0.11	-0.1311
DETRITUS	0.45 µm	-0.3069	-0.0971	0.3312	-0.29	-0.4284
DETRITUS	TOTAL	-0.5702	-0.1906	0.5993	-0.32	-0.7900
EPILITHON	TOTAL	-0.3202	-0.0408	0.4412	-0.09	-0.4819
COMBINED	TOTAL	-0.8904	-0.2314	1.0405	-0.22	-1.2719

Table H - 2 (cont.).

SITE: SMITH DATE: 13 August 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0728	-0.0428	0.514	-0.83	-0.0942
DETRITUS	1 mm	-0.0378	-0.0086	0.0500	-0.17	-0.0586
DETRITUS	250 µm	-0.0163	0.0005	0.0289	0.02	-0.0284
DETRITUS	75 µm	-0.0414	-0.0182	0.0398	-0.46	-0.0580
DETRITUS	0.45 µm	-0.4429	-0.1288	0.5383	-0.24	-0.6672
EPILITHON	4 mm	-0.0637	0.3701	0.7436	0.50	-0.3736
EPILITHON	1 mm	-0.1199	-0.0444	0.1294	-0.34	-0.1733
EPILITHON	250 µm	-0.2641	-0.0585	0.3524	-0.17	-0.4109
EPILITHON	75 µm	-0.0394	-0.0199	0.0335	-0.59	-0.0534
COMBINED	4 mm	-0.1365	0.3273	0.7951	0.41	-0.4678
COMBINED	1 mm	-0.1577	-0.0530	0.1794	-0.30	-0.2324
COMBINED	250 µm	-0.2804	-0.0580	0.3813	-0.15	-0.4393
COMBINED	75 µm	-0.0809	-0.0381	0.0733	-0.52	-0.1114
DETRITUS	0.45 µm	-0.4429	-0.1288	0.5383	-0.24	-0.6672
DETRITUS	TOTAL	-0.6112	-0.1979	0.7085	-0.28	-0.9064
EPILITHON	TOTAL	-0.4871	0.2472	1.2589	0.20	-1.0117
COMBINED	TOTAL	-1.0983	0.0493	1.9674	0.03	-1.9181

Table H - 2 (cont.).

SITE: B AVENUE DATE: 24 February 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0054	0.0004	0.0127	0.03	-0.0123
DETRITUS	1 mm	-0.0302	-0.0160	0.0311	-0.52	-0.0471
DETRITUS	250 µm	-0.0288	-0.0198	0.0197	-1.00	-0.0395
DETRITUS	75 µm	-0.0419	-0.0266	0.0335	-0.79	-0.0601
DETRITUS	0.45 µm	-0.1671	-0.0950	0.1578	-0.60	-0.2527
EPILITHON	4 mm	0.1011	0.2046	0.2264	0.09	-0.0218
EPILITHON	1 mm	-0.0475	-0.0383	0.0201	-1.91	-0.0584
EPILITHON	250 µm	0.0127	0.0247	0.0264	0.94	-0.0016
EPILITHON	75 µm	-0.0139	-0.0132	0.0015	-9.01	-0.0146
COMBINED	4 mm	0.0957	0.2050	0.2390	0.86	-0.0341
COMBINED	1 mm	-0.0777	-0.0543	0.0512	-1.06	-0.1055
COMBINED	250 µm	-0.0161	0.0050	0.0461	0.11	-0.0411
COMBINED	75 µm	-0.0558	-0.0398	0.0350	-1.14	-0.0748
DETRITUS	0.45 µm	-0.1671	-0.0950	0.1578	-0.60	-0.2527
DETRITUS	TOTAL	-0.2734	-0.1570	0.2548	-0.62	-0.4118
EPILITHON	TOTAL	0.0525	0.1778	0.2743	0.65	-0.0964
COMBINED	TOTAL	-0.2209	0.0209	0.5291	0.04	-0.5082

TABLE H - 2 (cont.).

SITE: B AVENUE DATE: 02 June 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP GO$_2$/M^{-2}D^{-1}	GCP GO$_2$/M^{-2}D^{-1}	CR GO$_2$/M^{-2}D^{-1}	P$_G$/R	NDM GO$_2$/M^{-2}D^{-1}
DETRITUS	4 mm	-0.0548	-0.0033	0.0820	-0.04	-0.0852
DETRITUS	1 mm	-0.1653	-0.0423	0.1958	-0.22	-0.2381
DETRITUS	250 µm	-0.1119	-0.0266	0.1358	-0.20	-0.1623
DETRITUS	75 µm	-0.1565	-0.0207	0.2161	-0.10	-0.2368
DETRITUS	0.45 µm	-0.3025	-0.0123	0.4617	-0.03	-0.4741
EPILITHON	4 mm	-0.3347	0.5241	1.3666	0.38	-0.8425
EPILITHON	1 mm	-0.0759	0.0320	0.1717	0.19	-0.1397
EPILITHON	250 µm	-0.2402	0.0313	0.4319	0.07	-0.4006
EPILITHON	75 µm	-0.0205	0.0054	0.0413	0.13	-0.0359
COMBINED	4 mm	-0.3895	0.5209	1.4486	0.36	-0.9277
COMBINED	1 mm	-0.2412	-0.0102	0.3675	-0.03	-0.3777
COMBINED	250 µm	-0.3521	0.0047	0.5676	0.01	-0.5629
COMBINED	75 µm	-0.1771	-0.0152	0.2575	-0.06	-0.2727
DETRITUS	0.45 µm	-0.3025	-0.0123	0.4617	-0.03	-0.4741
DETRITUS	TOTAL	-0.7910	-0.1051	1.0914	-0.10	-1.1965
EPILITHON	TOTAL	-0.6713	0.5929	2.0115	0.29	-1.4187
COMBINED	TOTAL	-1.4623	0.4878	3.1030	0.16	-2.6152

Table H - 2. (cont.).

SITE: B AVENUE DATE: 11 August 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0466	-0.0131	0.0571	-0.23	-0.0702
DETRITUS	1 mm	-0.1992	-0.0275	0.2927	-0.09	-0.3202
DETRITUS	250 µm	-0.2887	-0.0463	0.4130	-0.11	-0.4593
DETRITUS	75 µm	-0.1987	-0.0767	0.2078	-0.37	-0.2845
DETRITUS	0.45 µm	-0.5544	-0.1042	0.7672	-0.14	-0.8714
EPILITHON	4 mm	-0.9082	0.5148	2.4249	0.21	-1.9101
EPILITHON	1 mm	-0.2014	0.0173	0.3727	-.05	-0.3554
EPILITHON	250 µm	-0.1870	0.0449	0.3952	0.11	-0.3503
EPILITHON	75 µm	-0.0119	0.0155	0.0468	0.33	-0.0313
COMBINED	4 mm	-0.9548	0.5016	2.4820	0.20	-1.9803
COMBINED	1 mm	-0.4007	-0.0102	0.6654	-0.02	-0.6756
COMBINED	250 µm	-0.4757	-0.0015	0.8082	-0.00	-0.8096
COMBINED	75 µm	-0.2106	-0.0612	0.2546	-0.24	-0.3158
DETRITUS	0.45 µm	-0.5544	-0.1042	0.7672	-0.14	-0.8714
DETRITUS	TOTAL	-1.2876	-0.2679	1.73778	-0.15	-2.0056
EPILITHON	TOTAL	-1.3086	0.5925	3.2396	0.18	-2.6472
COMBINED	TOTAL	-2.5962	0.3246	4.9774	0.07	-4.6528

Table H - 2 (cont.).

SITE: UPPER 43RD DATE: 28 February 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0036	0.0050	0.0185	0.27	-0.0136
DETRITUS	1 mm	0.0015	0.0080	0.0140	0.57	-0.0060
DETRITUS	250 µm	-0.0145	0.0026	0.0368	0.07	-0.0341
DETRITUS	75 µm	-0.0344	-0.0068	0.0302	-.23	-0.0371
DETRITUS	0.45 µm	-0.0344	0.0327	0.1444	0.23	-0.1117
EPILITHON	4 mm	9.8445	9.9500	0.2271	43.82	9.7229
EPILITHON	1 mm	0.2696	0.2905	0.0449	6.46	0.2455
EPILITHON	250 µm	0.1474	0.1474	0.0000	0.00	0.1474
EPILITHON	75 µm	0.0296	0.0296	0.000	0.00	0.0296
COMBINED	4 mm	9.8409	9.9550	0.2456	40.53	9.7094
COMBINED	1 mm	0.2711	0.2985	0.0589	5.07	0.2396
COMBINED	250 µm	0.1330	0.1501	0.0368	4.08	0.1133
COMBINED	75 µm	0.0088	0.0228	0.0302	0.75	-0.0074
DETRITUS	0.45 µm	-0.0344	0.0327	0.1444	0.23	-0.1117
DETRITUS	TOTAL	-0.0719	0.414	0.2439	0.17	-0.2025
EPILITHON	TOTAL	10.2912	10.4176	0.2720	38.30	10.1455
COMBINED	TOTAL	10.2193	10.4590	0.5159	20.27	9.9431

Table H - 2. (cont.).

SITE: UPPER 43RD DATE: 12 June 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0709	-0.0016	0.1091	-0.01	-0.1107
DETRITUS	1 mm	-0.0428	0.0271	0.1101	0.25	-0.0830
DETRITUS	250 µm	0.0051	0.0416	0.0574	0.72	-0.0158
DETRITUS	75 µm	-0.0139	0.0584	0.1138	0.51	-0.0554
DETRITUS	0.45 µm	0.9609	1.3816	0.6628	2.08	0.7188
EPILITHON	4 mm	2.8204	4.3018	2.3340	1.84	1.9679
EPILITHON	1 mm	0.0687	0.1213	0.0828	1.46	0.0384
EPILITHON	250 µm	0.1692	0.2666	0.1535	1.74	0.1132
EPILITHON	75 µm	0.0243	0.0325	0.0130	2.51	0.0196
COMBINED	4 mm	2.7495	4.3002	2.4430	1.76	1.8572
COMBINED	1 mm	0.0259	0.1483	0.1929	0.77	-0.0446
COMBINED	250 µm	0.1744	0.3082	0.2109	1.46	0.0974
COMBINED	75 µm	0.0104	0.0909	0.1268	0.72	-0.0359
DETRITUS	0.45 µm	0.9606	1.3816	0.6628	2.08	0.7188
DETRITUS	TOTAL	0.8385	1.5070	1.0531	1.43	0.4539
EPILITHON	TOTAL	3.0826	4.7223	2.5832	1.83	2.1390
COMBINED	TOTAL	3.9212	6.2292	3.6363	1.71	2.5929

Table H - 2 (cont.).

SITE: UPPER 43RD DATE: 15 August 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-1}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0101	0.0111	0.366	0.30	-0.0254
DETRITUS	1 mm	-0.0495	-0.0114	0.0657	-0.17	-0.0771
DETRITUS	250 µm	-0.0757	-0.0033	0.1248	-0.03	-0.1282
DETRITUS	75 µm	0.0283	0.1389	0.1908	0.73	-0.0519
DETRITUS	0.45 µm	-0.2495	0.0584	0.5310	0.11	-0.4726
EPILITHON	4 mm	2.4750	3.3947	1.5861	2.14	1.8086
EPILITHON	1 mm	0.0738	0.1215	0.0824	1.48	0.0392
EPILITHON	250 µm	0.0365	0.0502	0.0236	2.13	0.0266
EPILITHON	75 µm	0.0152	0.0292	0.0242	1.21	0.0051
COMBINED	4 mm	2.4649	3.4059	1.6227	2.10	1.7832
COMBINED	1 mm	0.0243	0.1101	0.1481	0.74	-0.0379
COMBINED	250 µm	-0.0392	0.0469	0.1484	0.32	-0.1016
COMBINED	75 µm	0.0435	0.1681	0.2149	0.78	-0.0468
DETRITUS	0.45 µm	-0.2495	0.0584	0.5310	0.11	-0.4726
DETRITUS	TOTAL	-0.3565	0.1937	0.9488	0.20	-0.7551
EPILITHON	TOTAL	2.6005	3.5957	1.7162	2.10	1.8795
COMBINED	TOTAL	2.2440	3.7894	2.6651	1.42	1.1243

Table H - 2. (cont.).

SITE: NAGEL DATE: 03 March 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0021	0.0032	0.0113	0.28	-0.0081
DETRITUS	1 mm	-0.0143	-0.0079	0.0137	-0.57	--.0216
DETRITUS	250 µm	-0.0144	-0.0083	0.0130	-0.64	-0.0213
DETRITUS	75 µm	-0.0195	-0.0114	0.0172	-0.67	-0.0286
DETRITUS	0.45 µm	-0.0512	-0.0228	0.0601	-0.38	-0.0829
EPILITHON	4 mm	2.0705	2.1999	0.2740	8.03	1.9259
EPILITHON	1 mm	0.0410	0.0417	0.0015	27.62	0.0402
EPILITHON	250 µm	0.5737	0.5737	0.0000	0.00	0.5737
EPILITHON	75 µm	0.0082	0.0082	0.0001	101.95	0.0081
COMBINED	4 mm	2.0684	2.2031	0.2853	7.72	1.9178
COMBINED	1 mm	0.0266	0.0338	0.0152	2.22	0.0186
COMBINED	250 µm	0.5592	0.5654	0.0130	43.45	0.5524
COMBINED	75 µm	-0.0114	-0.0032	0.0172	-0.19	-0.0206
DETRITUS	TOTAL	-0.1016	-0.0472	0.1153	-0.41	-0.1625
EPILITHON	TOTAL	2.6933	2.8235	0.2756	10.24	2.5479
COMBINED	TOTAL	2.5917	2.7763	0.3909	7.10	2.3854

Table H - 2 (cont.)

SITE: NAGEL DATE: 04 June 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0317	-0.0047	0.0429	-0.11	-0.0476
DETRITUS	1 mm	-0.0251	-0.0077	0.0276	-0.28	-0.0353
DETRITUS	250 µm	-0.0480	-0.0161	0.0506	-0.32	-0.0666
DETRITUS	75 µm	-0.0224	-0.0038	0.0294	-0.13	-0.0332
DETRITUS	0.45 µm	-0.2384	0.0978	0.5332	0.18	-0.4353
EPILITHON	4 mm	2.0393	4.2717	3.5404	1.21	0.7313
EPILITHON	1 mm	0.4558	0.7086	0.4010	1.77	0.3076
EPILITHON	250 µm	0.4484	0.7308	0.4477	1.63	0.2830
EPILITHON	75 µm	0.0387	0.0639	0.0400	1.60	0.0239
COMBINED	4 mm	2.0076	4.2670	3.5833	1.19	0.6837
COMBINED	1 mm	0.4307	0.7010	0.4286	1.64	0.2723
COMBINED	250 µm	0.4005	0.7147	0.4983	1.43	0.2164
COMBINED	75 µm	0.0163	0.0601	0.0694	0.87	-0.0093
DETRITUS	0.45 µm	-0.2384	0.0978	0.5332	0.18	-0.4353
DETRITUS	TOTAL	-0.3655	0.0655	0.6836	0.10	-0.6181
EPILITHON	TOTAL	2.9822	5.7750	4.4292	1.30	1.3459
COMBINED	TOTAL	2.6167	5.8406	5.1128	1.14	0.7278

Table H - 2. (cont.)

SITE: NAGEL DATE: 18 August 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0018	0.0050	0.0119	0.42	-0.0068
DETRITUS	1 mm	-0.0040	0.0151	0.0333	0.45	-0.0182
DETRITUS	250 µm	-0.0175	0.0062	0.0413	0.15	-0.0351
DETRITUS	75 µm	-0.0605	-0.0108	0.0866	-0.12	-0.0974
DETRITUS	0.45 µm	-0.0442	0.1975	0.4213	0.47	-0.2238
EPILITHON	4 mm	3.2310	4.6062	2.3975	1.92	2.2087
EPILITHON	1 mm	-0.0307	0.0831	0.1984	0.42	-0.1153
EPILITHON	250 µm	0.0098	0.0438	0.0593	0.74	-0.0155
EPILITHON	75 µm	0.0192	0.0412	0.0382	1.08	0.0030
COMBINED	4 mm	3.2292	4.6112	2.4094	1.91	2.2019
COMBINED	1 mm	-0.0347	0.0982	0.2317	0.42	-0.1335
COMBINED	250 µm	-0.0077	0.0500	0.1005	0.50	-0.0506
COMBINED	75 µm	-0.0412	0.0304	0.1248	0.24	-0.0944
DETRITUS	0.45 µm	-0.0442	0.1975	0.4213	0.47	-0.2238
DETRITUS	TOTAL	0.1279	0.2130	0.5943	0.36	-0.3813
EPILITHON	TOTAL	3.2293	4.7743	2.6934	1.77	2.0809
COMBINED	TOTAL	3.1014	4.9873	3.2877	1.52	1.6996

Table H - 2. (cont.).

SITE: KELLOGG FOREST DATE: 06 March 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0085	-0.0018	0.0107	-0.16	-0.0125
DETRITUS	1 mm	-0.0514	-0.0037	0.0755	-0.05	-0.0792
DETRITUS	250 µm	-0.0583	-0.0181	0.0635	-0.29	-0.0816
DETRITUS	75 µm	-0.0832	-0.0084	0.1183	-0.07	-0.1267
DETRITUS	0.45 µm	-0.1105	0.2752	0.6104	0.45	-0.3352
EPILITHON	4 mm	3.1854	4.5516	2.1618	2.11	2.3898
EPILITHON	1 mm	0.0913	0.1907	0.1573	1.21	0.0334
EPILITHON	250 µm	0.2128	0.3343	0.1922	1.74	0.1420
EPILITHON	75 µm	0.2526	0.3812	0.2035	1.87	0.1776
COMBINED	4 mm	3.1769	4.598	2.1725	2.09	2.3773
COMBINED	1 mm	0.0399	0.1870	0.2328	0.80	-0.0458
COMBINED	250 µm	0.1545	0.3161	0.2557	1.24	0.0604
COMBINED	75 µm	0.1694	0.3728	0.3218	1.16	0.0509
DETRITUS	0.45 µm	-0.1105	0.2752	0.6104	0.45	-0.3352
DETRITUS	TOTAL	-0.3119	0.2432	0.8784	0.28	-0.6352
EPILITHON	TOTAL	3.7421	5.4577	2.7148	12.01	2.7429
COMBINED	TOTAL	3.4302	5.7009	3.5932	1.59	2.1077

Table H - 2 (cont.).

SITE: KELLOGG FOREST DATE: 05 June 1975

SEDIMENT TYPE	PARTICLE SIZE	NCP $GO_2/M^{-2}D^{-1}$	GCP $GO_2/M^{-2}D^{-1}$	CR $GO_2/M^{-2}D^{-1}$	P_G/R	NDM $GO_2/M^{-2}D^{-1}$
DETRITUS	4 mm	-0.0001	0.0097	0.0207	0.47	-0.0110
DETRITUS	1 mm	-0.0095	0.0197	0.0614	0.32	-0.0417
DETRITUS	250 µm	-0.0160	0.0077	0.0498	0.15	-0.0421
DETRITUS	75 µm	-0.0346	0.0175	0.1095	0.16	-0.0920
DETRITUS	0.45 µm	-0.0722	0.1461	0.4588	0.32	-0.3128
EPILITHON	4 mm	1.6342	2.2674	1.3310	1.70	0.9364
EPILITHON	1 mm	0.0795	0.1336	0.1136	1.18	0.0200
EPILITHON	250 µm	0.0460	0.0578	0.0247	2.34	0.0331
EPILITHON	75 µm	-0.0021	-0.0007	0.0030	-0.22	-0.0036
COMBINED	4 mm	1.6341	2.2771	1.3517	1.68	0.9254
COMBINED	1 mm	0.0701	0.1533	0.1750	0.88	-0.0217
COMBINED	250 µm	0.0301	0.0655	0.0745	0.88	-0.0090
COMBINED	75 µm	-0.0366	0.0169	0.1125	0.15	-0.0956
DETRITUS	0.45 µm	-0.0722	0.1461	0.4588	0.32	-0.3128
DETRITUS	TOTAL	-0.1323	0.2008	0.7002	0.29	-0.4995
EPILITHON	TOTAL	1.7577	2.4581	1.4723	1.67	0.9858
COMBINED	TOTAL	1.6254	2.6588	2.1725	1.22	0.4863