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Huron Mountain Club

Project

Prepared

By

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TITLE: Response of aquatic macroinvertebrates to riparian hinge-cut alder cover in the Salmon Trout River, Marquette County, Michigan.

OBJECTIVE: To determine the effect of riparian hinge-cutting on stream macroinvertebrate abundance and biomass in the Salmon Trout River, Michigan.

BACKGROUND: (See Ultis thesis for background material).

Materials and Methods

To assess aquatic macroinvertebrate abundance and biomass, two sets of samples were collected between the ~~Upper~~ Lower and Middle Falls of the Salmon Trout River (sects, 14 and 15, Powell Township, Marquette County, Michigan) on 16-17 May 81 and 29-30 July 81. Specifically, samples were collected from sites 38 and 47 which were 100 meter sections designated as such by an earlier mark-recapture study of stream vertebrates. Two sampling dates were chosen to determine if there were temporal differences in macroinvertebrates abundance on hinge cuttings.

Four substrates were sampled: 1) twigs of hinge cuttings; 2) leaf packs attached to hinge cuttings; 3) bottom sediments directly downstream of hinge cuttings; and 4) unobstructed bottom sediments.

1. HINGE CUTTINGS: In the spring of 1980 several sections of stream bank foliated with speckled alder (Alnus incana(L.)) were hinge cut to assess the impact of this practice on vertebrate (fish) biomass in the stream. This practice consisted of partially severing the bush at its base which allowed the canopy to fall into the stream channel, but at the same time anchored it in place. On each sampling date, eight 30-35 cm sections of submerged twigs were randomly sampled from each of the two sample areas to assess colonization by stream macroinvertebrates. Each twig sample was divided into smaller sections

and cleaned of invertebrates at stream side. The invertebrates from each section were then stored in vials of 80% ETOH for later examination and processing at the laboratory. The surface area of each twig sampled was calculated using the formula:

$$A=Pi\ rl,$$

where r=twig radius and l=twig length.

2. LEAF PACKS: Eight leaf litter pack samples were taken from each area. The leaf litter packs were formed as a result of hinge cuttings trapping floating vegetation moving downstream through the stream system. The packs consisted of several leaf species and assorted debris, mainly oak, maple, grasses and alder. No leaf packs were present on hinge cuttings during the second sampling period. Each pack collected was emersed in 80% ETOH and sorted to separate the invertebrate fauna from the substrate. The invertebrates from each pack were stored in vials of 80% ETOH for later processing. Leaf packs were dried separately in an oven at 100 degrees C for four days and weighed to determine the dry weight of each pack.

3. HINGE SEDIMENTS: The hinge cut alders had two observable physical effects on the stream bed: 1) the stream channel immediately below hinge cuts was narrowed, causing the current to scour and deepen the center of the channel; and 2) the creation of backwash or sedimentation areas directly downstream of the hinge cuttings. Eight samples of hinge sediments were taken from each of two areas using the kick sample method (Frost et. al. 1970). A "D" Frame aquatic net was used to collect the samples. They were then sorted and stored in alcohol vials as described above.

4. CONTROL: Areas of the stream channel (sediments) unaffected by the hinge cutting practices were sampled and processed as above to provide a base for comparison.

Specimens were sorted, counted and identified to the lowest possible taxon using Merritt and Cummins (1978). After identification, the body length of each individual in different taxa (labrum to posterior of last abdominal segment) was measured and the regression formula:

$$\ln W = \ln a + b \ln L,$$

where W = dry weight (mg); L = body length (mm), and a and b are constants (Smock 1980) was used to calculate weight from length for biomass determinations.

Results & Discussion

Ten orders, 26 families and 22 genera of aquatic macroinvertebrates were identified from twig and bottom samples (Table 1). Mayflies (Ephemeroptera) and caddisflies (Trichoptera) were the two most common orders.

Although the total number of individuals collected on twig and bottom samples was only slightly higher in July than May, the July samples contained approximately 16 times the biomass (mg) (Table 1). This large difference was due to the presence of late nymphal instars of *Pteronarcys* sp., *Cordulegaster* sp. and larvae of *Arctopsyche* sp., *Hydropsyche* sp. and *Atherix* sp. in the July samples. These immature stages, although present in May, were 2 to 3 times the size in July samples.

Leaf packs collected in May were heavily colonized by stream invertebrates, containing 4.19 individuals/gm dry wt. leaf. Biomass estimates (dry wt.) showed there were 9.17 mg of insect biomass for every gm of leaf biomass. Two genera of mayflies *Ephemerella* sp. and *Paraleptophlebia* sp., probably leaf shredders (Merritt and Cummins 1978), were the most common taxa collected in leaf packs.

The relationship between insect biomass and twig surface area is shown in Figure 1. Twigs with larger surface area supported higher insect biomass. Twig samples (or snags) were dominated by filter-feeding caddisflies, eg., *Arctopsyche* sp., *Hydropsyche* sp. and *Brachycentrus* sp. Filter-feeders comprised over 80% of the biomass (Fig. 2) and 75% of the number (Fig. 3) in the May samples. Although the percentages are lower in July than May (Figs. 4 & 5), filter-feeders were still the most representative group on twigs on both dates. Other studies (Cudney and Wallace 1980; Benke et. al. 1979) have also shown that filter-feeding caddisflies are the most important colonizers of the snag habitat and Benke et. al. (1979)

indicated that larval caddisflies on submerged branches are a significant food resource for fish.

Hinge sediment samples in May and July were characterized by a high biomass of predators (Figs. 2 and 4). The predators included Cordulegaster sp., Alloperla sp. and Atherix sp. Numerically, gatherers and filterers (Figs. 3 and 5) were as abundant as predators. Bottom samples immediately adjacent to or under hinge cuttings had a higher biomass of aquatic invertebrates (May: 162.8 mg dry wt./ft^2; July: 1180.5 mg dry wt/ft^2) than comparable control sample sites (May: 132.0 mg dry wt/ft^2; July: 490.7 mg dry wt/ft^2). The biomass differences were probably due to the scouring effect of the current associated with the hinge cuts. Many aquatic insects prefer areas of higher current speed and larger substrate size (Hynes 1970, Ulfstrand 1967). The hinge cutting apparently improved the habitat for aquatic insects by increasing the current speed and washing out fine sediments.

From the data presented it is clear that the practice of hinge cutting created a variety of habitats for macroinvertebrate colonization and it increased their abundance and biomass in the Salmon Trout River. The hinge cuttings increased the surface area for attachment (twig or snag surface) and also served to trap leaf litter during spring which provided an additional substrate for macroinvertebrate colonization. The bottom sediments immediately below and adjacent to the hinge cuttings also affected macroinvertebrate abundance as described above. The major functional invertebrate groups inhabiting stream substrates were shredders and filter-feeding insects.

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Table 1. A taxonomic list of the macroinvertebrates (with total biomass) collected from the Salmon Trout River, Michigan, on two different sampling dates.

Taxon	Total Biomass (mg) 16 May 81	Total Biomass (mg) 29 July 81
Ephemeroptera		
Metretopodidae		
Siphloplecton sp.	38.2	0
Baetidae		
Baetis spp.	27.6	132.3
Heptageniidae		
Stenonema sp.	20.2	83.3
Ephemerellidae		
Ephemerella spp.	205.8	188.4
Leptophlebiidae		
Paraleptophlebia sp.	17.9	1.0
Ephemeridae		
Ephemera sp.	98.2	0
Odonata		
Cordulegastridae		
Cordulegaster sp.	1031.0	4917.4
Gomphidae	0.45	41.6
Plecoptera		
Pteronarcidae		
Pteronarcys sp.	150.6	6265.6
Nemouridae		
Nemoura sp.	7.3	3.8
Perlodidae		
Isoperla sp.	83.9	55.1
Trichoptera		
Philopotamidae		
Dolophilodes sp.	0	821.8
Hydropsychidae		
Hydropsyche sp.	55.4	493.6
Arctopsyche sp.	63.5	4325.0
Glossosomatidae		
Glossosoma sp.	3.3	13.7
Brachycentridae		
Brachycentrus sp.	176.9	381.1
Lepidostomatidae		
Lepidostoma sp.	10.5	39.3
Limnephilidae		
Hesperophylax sp.	29.5	0
Pycnopsyche sp.	33.0	0
Goera sp.	3.6	0
Coleoptera		
Haliplidae	2.2	0
Elmidae	1.5	382.5
Diptera		
Simuliidae	0.5	14.7
Chironomidae	19.7	83.0
Tipulidae		
Hexatoma sp.	12.3	192.7
Tabanidae		
Chrysops sp.	22.1	1.7
Athericidae		
Atherix sp.	9.04	287.7

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Figure 1

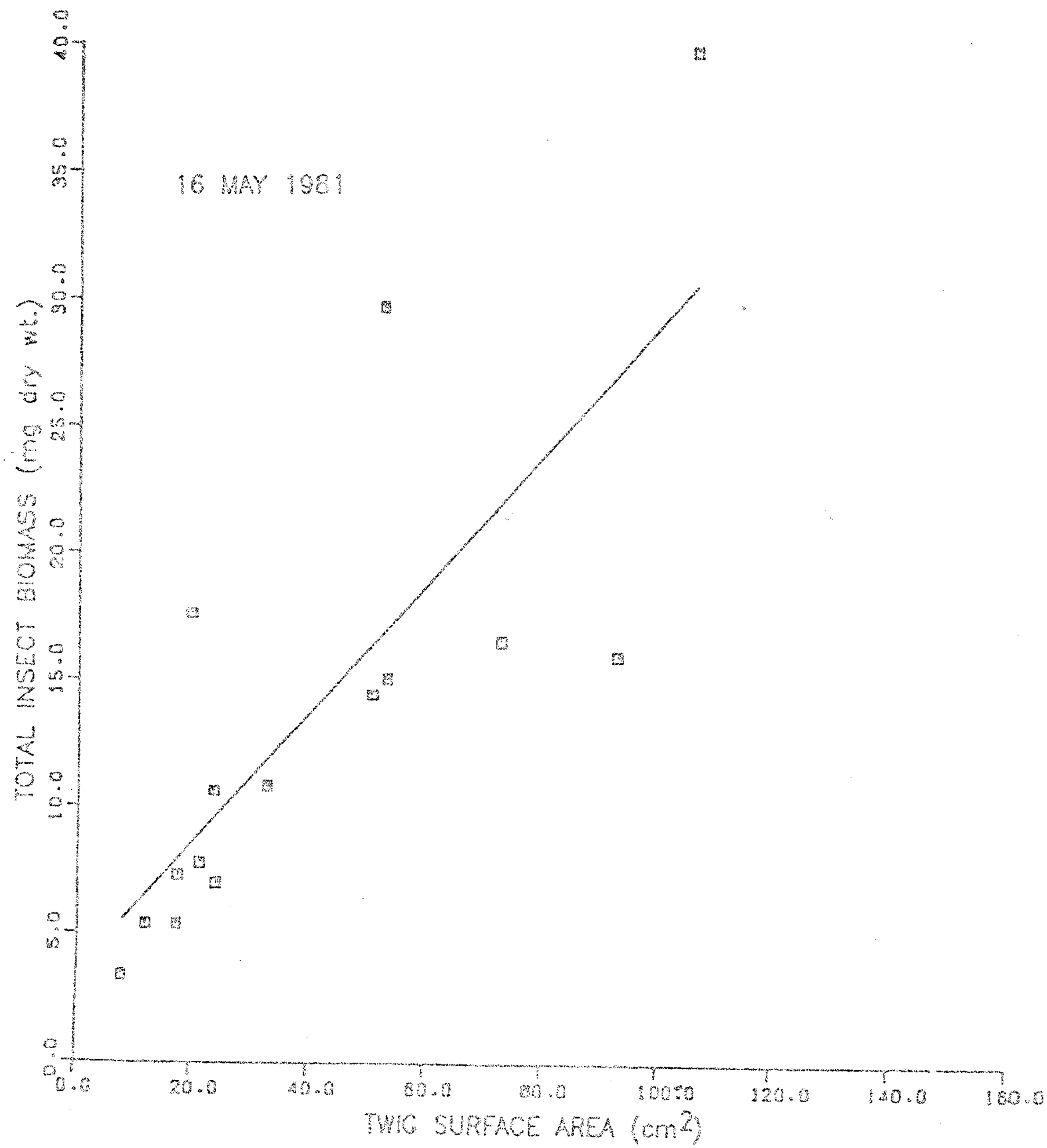
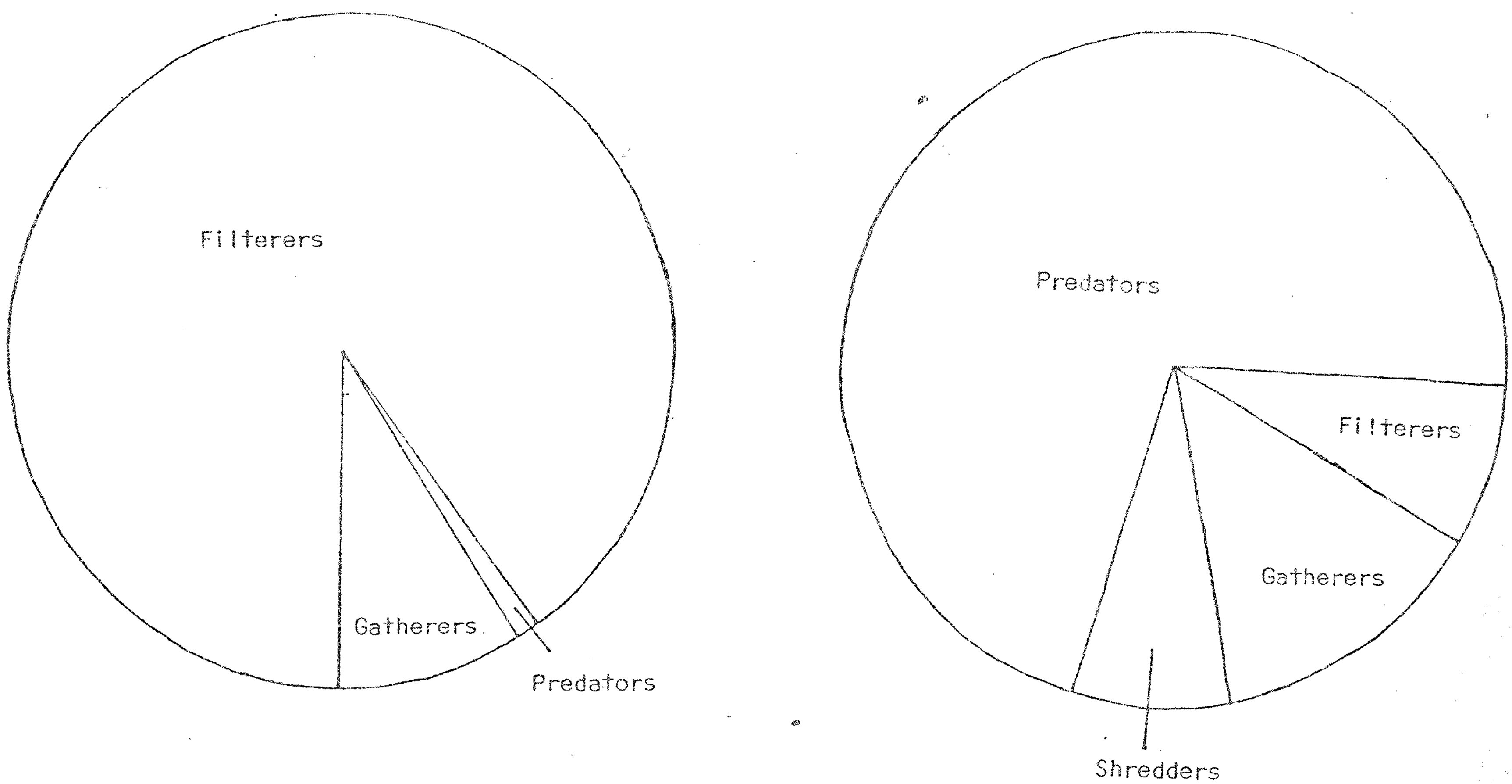

16 MAY 1981
TOTAL INSECT BIOMASS (mg dry wt.)
TWIG SURFACE AREA (cm2)

Figure 2

Comparison of Insect Trophic Relationships between Twig and Bottom Samples, 16 May 1981 (based on biomass)



Twig Samples

Bottom Samples

Figure 3

Comparison of Insect Trophic Relationships between Twig and Bottom Samples 16 May 1981 (based on numbers).

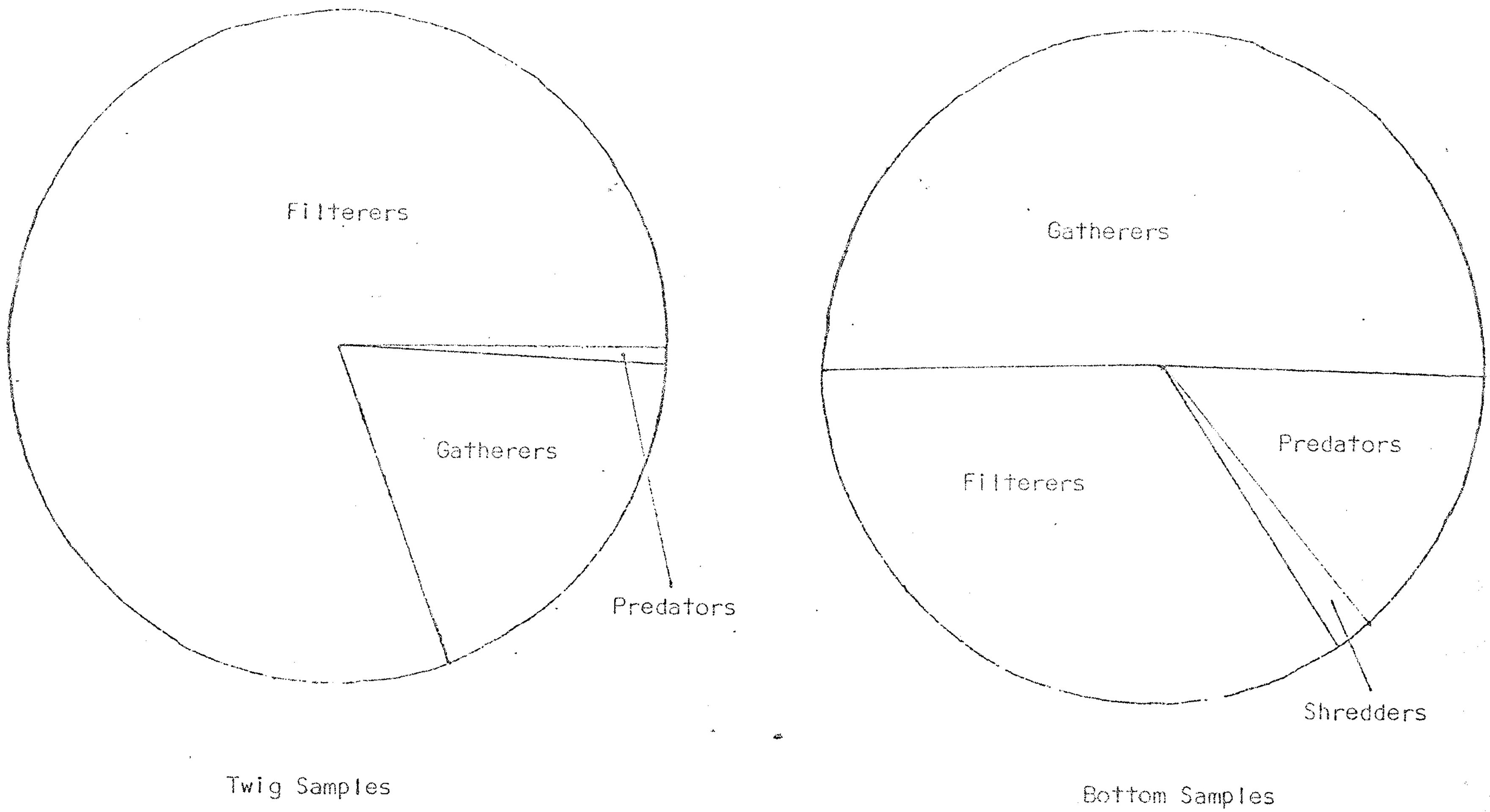


Figure 4

Comparison of Insect Trophic Relationships between Twig and Bottom Samples 29 July 1981 (based on biomass).

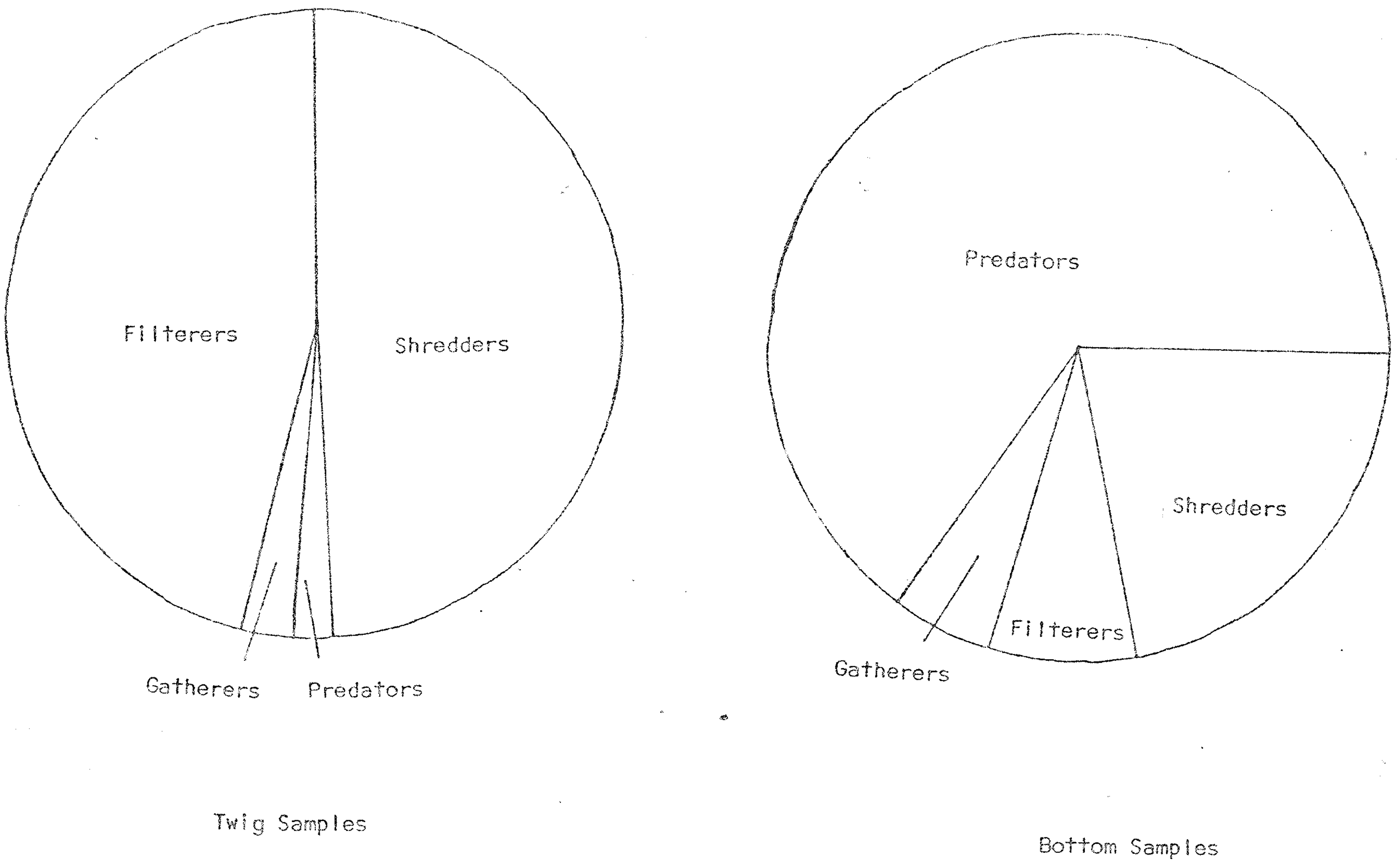


Figure 5

Comparison of Insect Trophic Relationships between Twig and Bottom Samples 29 July 1981 (based on numbers).