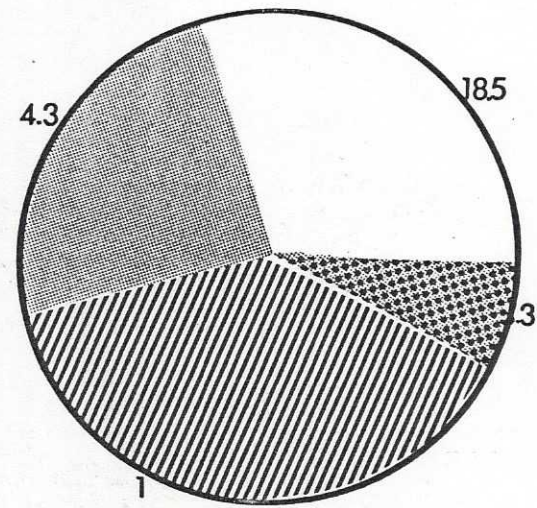
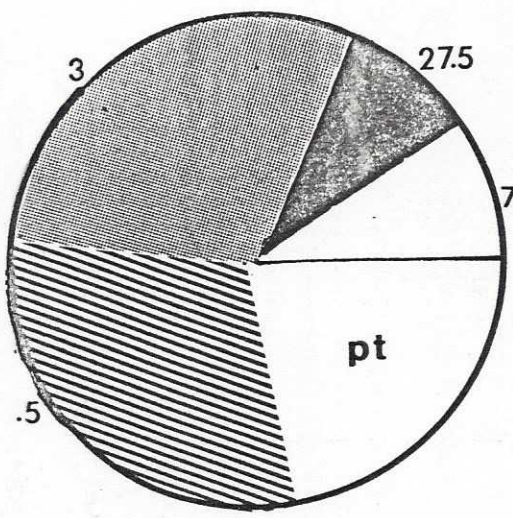


# PUMPKINSEED

## GROUP 1

12-45mm

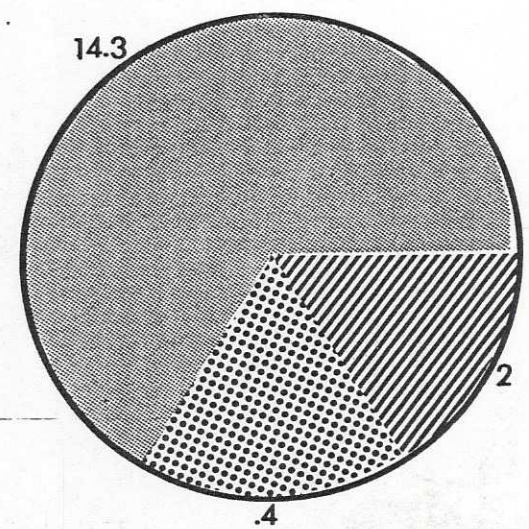
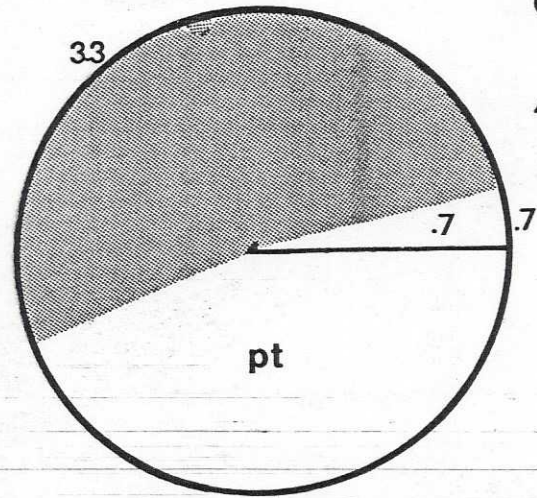
2 Sample 4 size



## GROUP 11

48-95mm

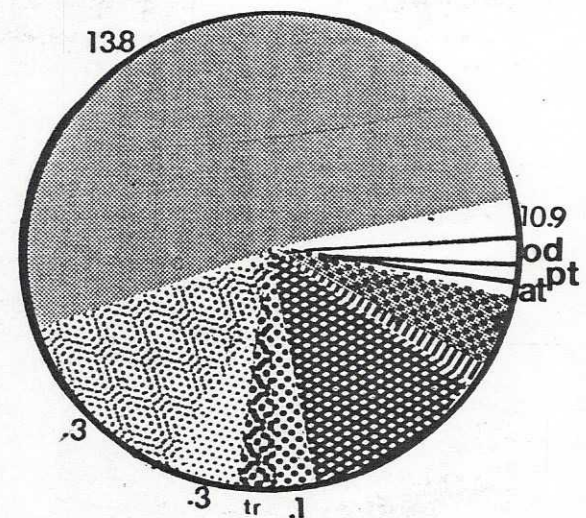
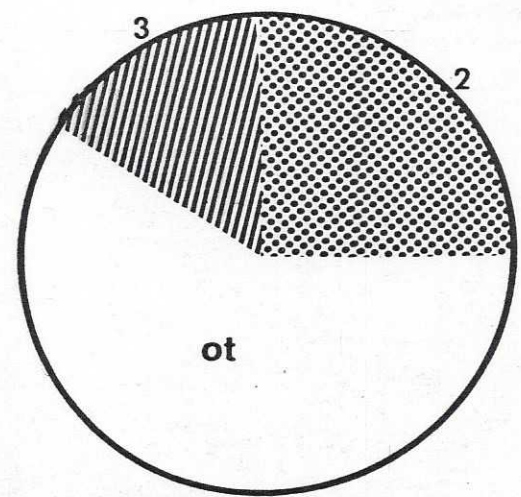
4 Sample 9 size



## GROUP 111

96-145mm

1 Sample 27 size



MAY

JULY





data for May are inconclusive as the data is based on a single fish whose stomach contained an adult coleopteran.

The overall picture is of a generalist benthic feeder selecting prey by size as described by Keast and Welsh (1968) and Reid (1930) (cited in Scott and Crossman, 1974).

data for May are indicative as the data is based on a  
single fish whose stomach contained an adult coelocystis-

an.

The overall picture is of a generalist benthic  
feeder rejecting prey by size as described by Kestel and  
Welsh (1958) and Reid (1958) (cited in Scott and Cross-  
man, 1974).

## Rock Bass

(N=78; group I M=26, J=0; group II M=0, J=1)

Two size categories of Rock Bass are distinguished in Figures 27 and 28. These represent the one year old fish from May and a single full stomach of a 144 mm fish from July respectively.

Group I fish take a broad range of benthic and planktonic organisms with a numerical emphasis on Cladocera and a volume emphasis on chironomids. Trace numbers of the larger bodied insect nymphs contribute less than 3% each to the volume, Amphipods (6.8%) and terrestrial insects (8.5%) are more important.

The group II fish contained 2 small decapods (0 - 10 mm) for 99% of the stomach volume.

Keast (1965) describes a juvenile diet of small benthic invertebrates with an early transition to larger and larger prey (Odonata nymphs ; up to 75%, Ephemeroptera 35%, Trichoptera 35%, fish fry 30%, crayfish >15%) facilitated by the wide mouth aperture (Keast and Webb, 1966). The climax diet is described as almost exclusively Decapoda and Anisoptera nymphs. This agrees with the observed diet for Sunfish Lake.

(H-78; group I M-35, J-4; group II M-35, J-4)

Two size categories of rock bass are distinguished in figures 17 and 18. These represent the one year old fish from May and a single full stomach of a 144 mm fish from July respectively.

Group I fish take a broad range of benthic and planktonic organisms with a numerical emphasis on cladocera and a volume emphasis on chironomids. Numbers of the larger bodied insect nymphs contribute less than 3% each to the volume. Amphipods (6.8%) and terrestrial insects (8.5%) are more important.

The group II fish contained 1 small sculpin (6.1%) and 99% of the stomach volume.

Kennel (1965) described a juvenile diet of small benthic invertebrates with an early transition to larger and larger prey (Odonata nymphs : up to 15%, Ephemeroptera 32%, Trichoptera 32%, fish 30%, crayfish 15%) localized by the wide mouth species (Kenne and Webb, 1966). The climax diet is described as almost exclusively detritus and dipteran nymphs. This agrees with the observed diet for Guntah Lake.

Figure 17:

A scatter plot of length versus weight for the Rock Bass. The size divisions

corresponding to Groups are shown.

Group 1	30-50 mm
Group 2	110-145 mm

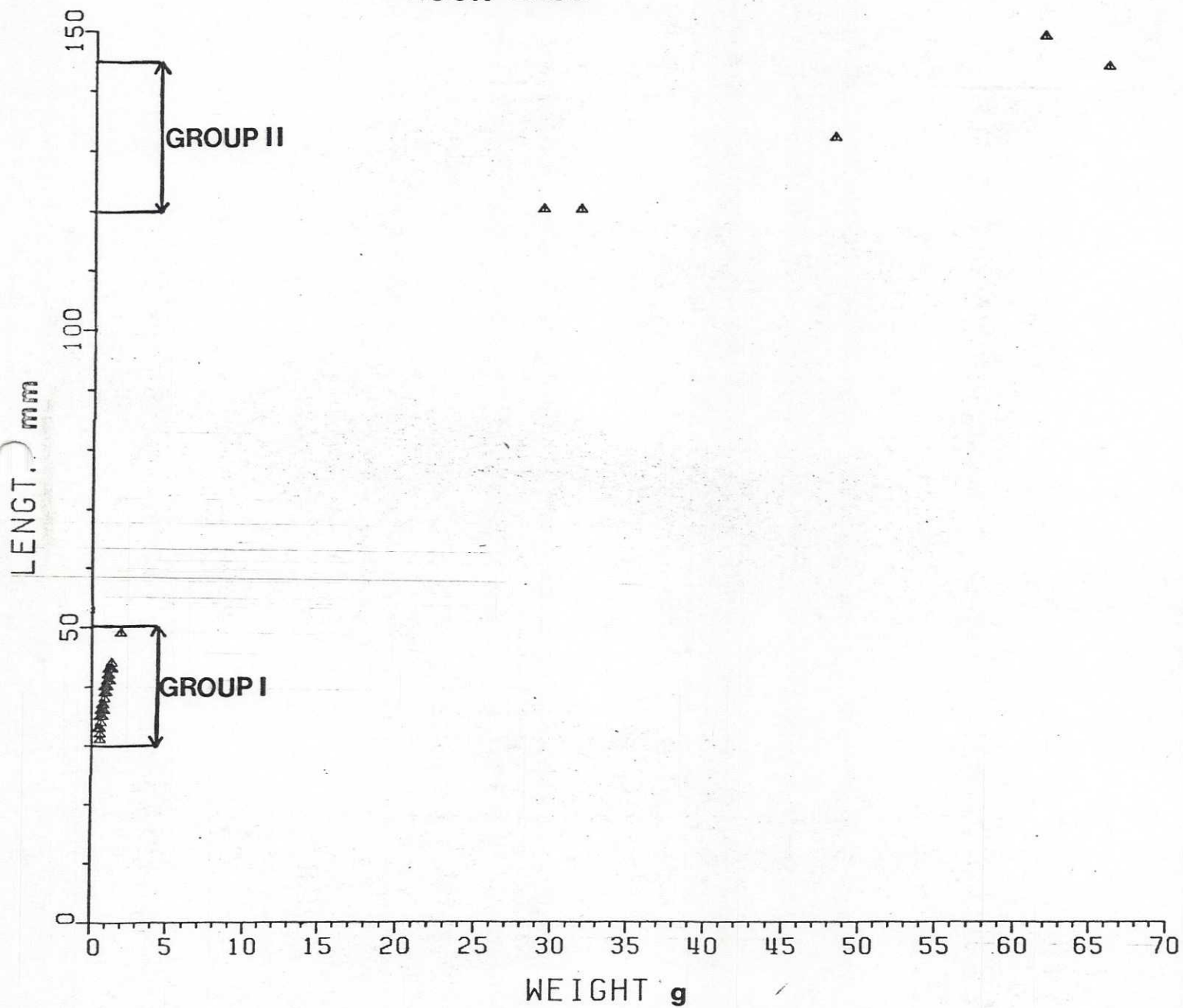
Figure 27:

A scatter plot of length versus weight for the Rock Bass. The size divisions corresponding to Groups are shown.

Group 1	30-50 mm
Group 2	120-145 mm



# ROCK BASS



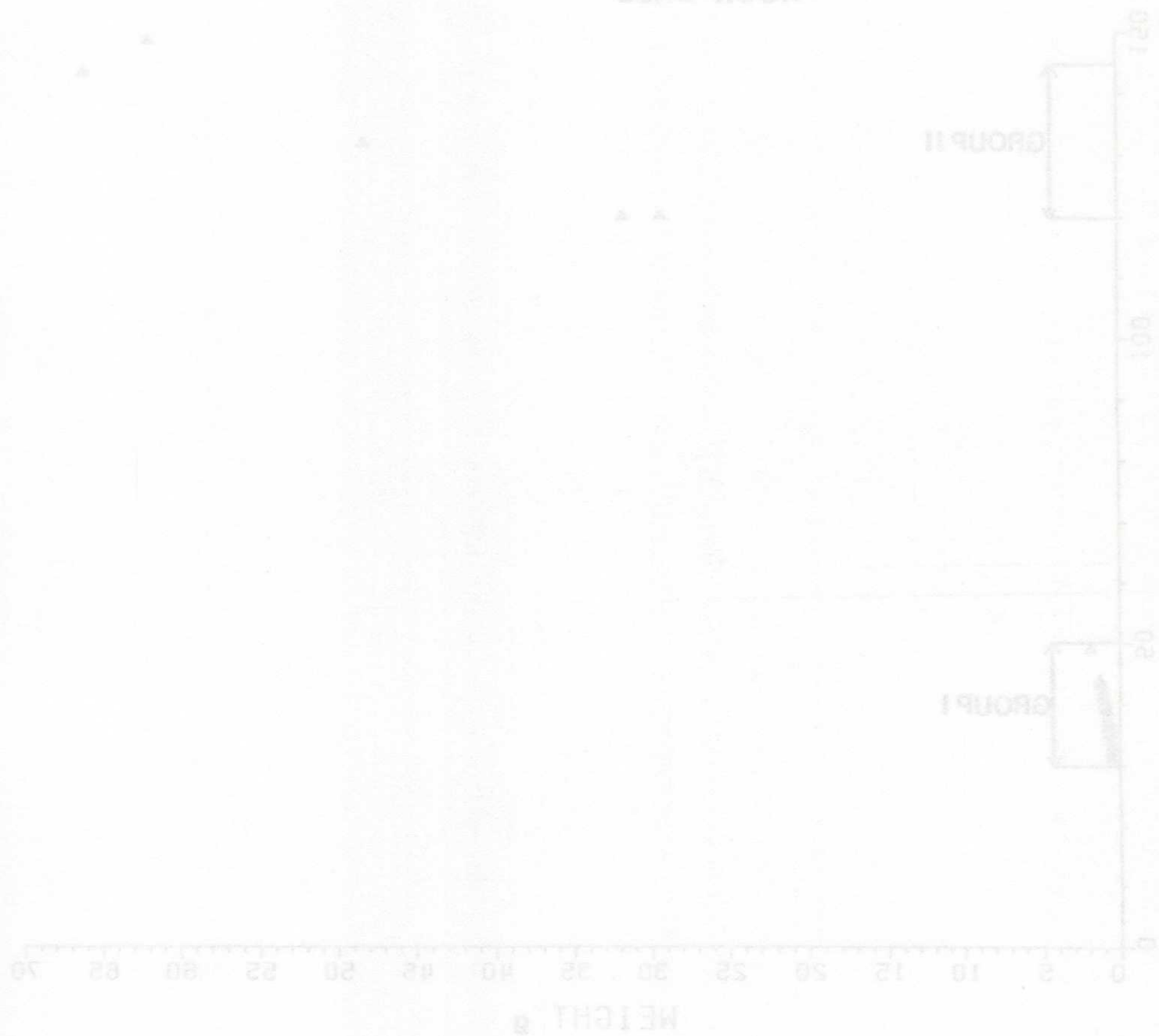


Figure 18:

The diet of the rock bass. The size of each slice represents the percent

volume contribution of each prey taxon to the total stomach contents.

The peripheral numbers are the mean number of prey items this would represent.

The sample size is shown for each taxon.

- 1 cladocera
- 2 copepodites/nauplii
- 3 chironomid larvae
- 4 decapoda
- 5 amphipods
- 6 scud
- 7 Ephemera nymphs
- 8 Ephemera nymphs
- 9 Ephemera nymphs
- 10 Ephemera larvae
- 11 Ephemera
- 12 Ephemera
- 13 Ephemera
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- 99 Ephemera
- 100 Ephemera

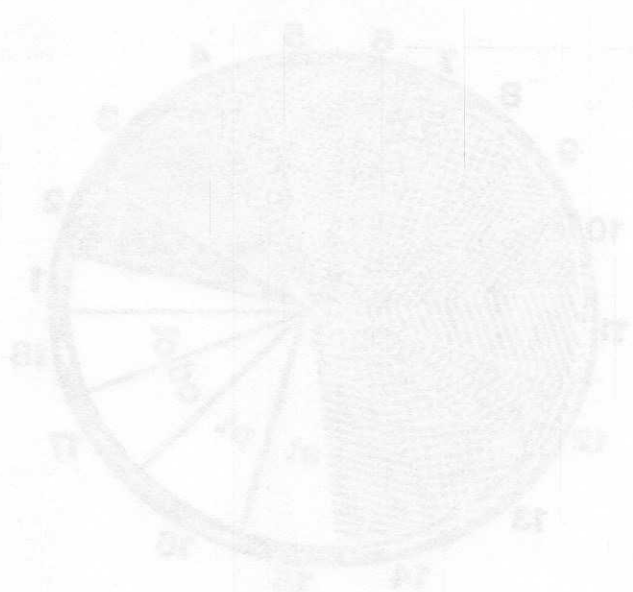
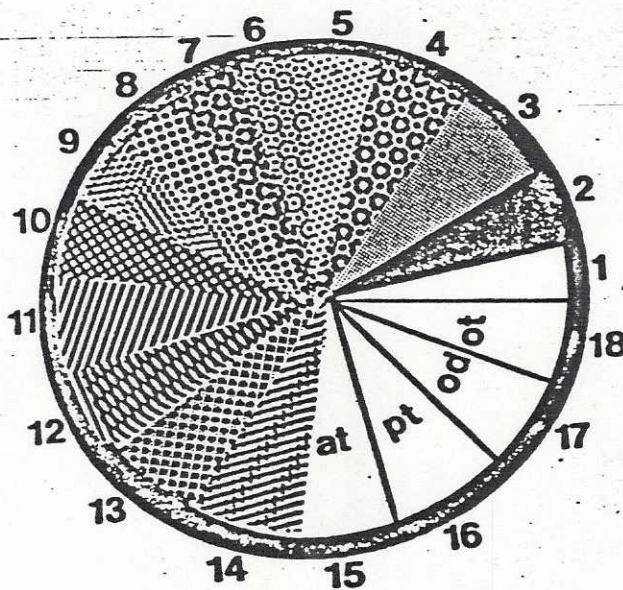


Figure 28:

The diet of the Rock Bass. The size of each slice represents the percent volume contribution of each prey taxocene to the total stomach contents. The peripheral numbers are the mean number of prey items this would represent. The sample size is shown for each diagram.



- 1 cladocerans
- 2 copepods/ostracods
- 3 chironomid larvae
- 4 decapods
- 5 anisoptera nymphs
- 6 zygoptera nymphs
- 7 Ephemerella nymphs
- 8 Hexagenia nymphs
- 9 trichopteran larvae
- 10 Viviparus
- 11 amphipods
- 12 hydracarina
- 13 terrestrial insects
- 14 fish
- 15 animal tissue
- 16 plant tissue
- 17 organic debris
- 18 other









## Largemouth Bass

(N=57; group I M=, J=8; group II M=1, J=8)

Two size categories of Largemouth Bass are distinguished in Figures 29 and 30. Based on growth rates in Scott and Crossman (1974), group I contains only one year old fish.

In May, the diet of group I fish is dominated by cladocerans (35%) with Odonata nymphs (Anisoptera 10%, Zygoptera 10%), Ephemerella (17.5%) and Hyaletella (10%) making significant volume contributions. In July the amphipod, Hyaletella, increases in importance (26.3%) relative to the cladocera (16.3%) and fish become the most important resource on a volume basis (38.7%). Group II fish are also piscivorous although chironomids (44%) and decapods (12.5%) are of greatly increased importance and plant tissue has become the most bulky stomach content.

The large mouth aperture enables Largemouth Bass to become piscivorous at just 50 mm in length (Scott and Crossman 1974) and the above diet correlates well with that described by Keast and Webb (1966) who indicate that the juvenile, after a brief (1 - 2 month) dietary concentration on Cladocera, shifts to benthic inverteb-

Largemouth Bass

(N=57; group I N=3; group II N=1, 2-3)

Two size categories of largemouth bass are distinguished in figures 25 and 26. Based on growth rates in Scott and Crossman (1974), group I contains only one year old fish.

In May, the diet of group I fish is dominated by cladocerans (33%) with Chironomus nymphs (Anisopoda 18%), Hydropsyche 12%, Ephemeroptera (17.5%) and Uvulifera (18%) making significant volume contributions. In July the amphipod, Hyalella, increases in importance (26.3%) relative to the cladocera (16.3%) and fish become the most important resource on a volume basis (32.7%). Group II fish are also piscivorous although chironomids (44%) and decapods (13.5%) are of greatly increased importance and plant material has become the most bulky stomach content.

The large mouth aperture enables largemouth bass to become piscivorous at just 25 mm length (Scott and Crossman 1974) and the above diet correlates well with that described by Keast and Webb (1966) who indicate that the juvenile, after a brief (1 - 2 month) dietary concentration on Cladocera, shifts to benthic invertebrates.

Figure 10.

A scatter plot of length versus weight for the largemouth bass. The size

divisions corresponding to groups are shown.

Group 1	50-119 mm
Group 2	120-249 mm

Figure 29:

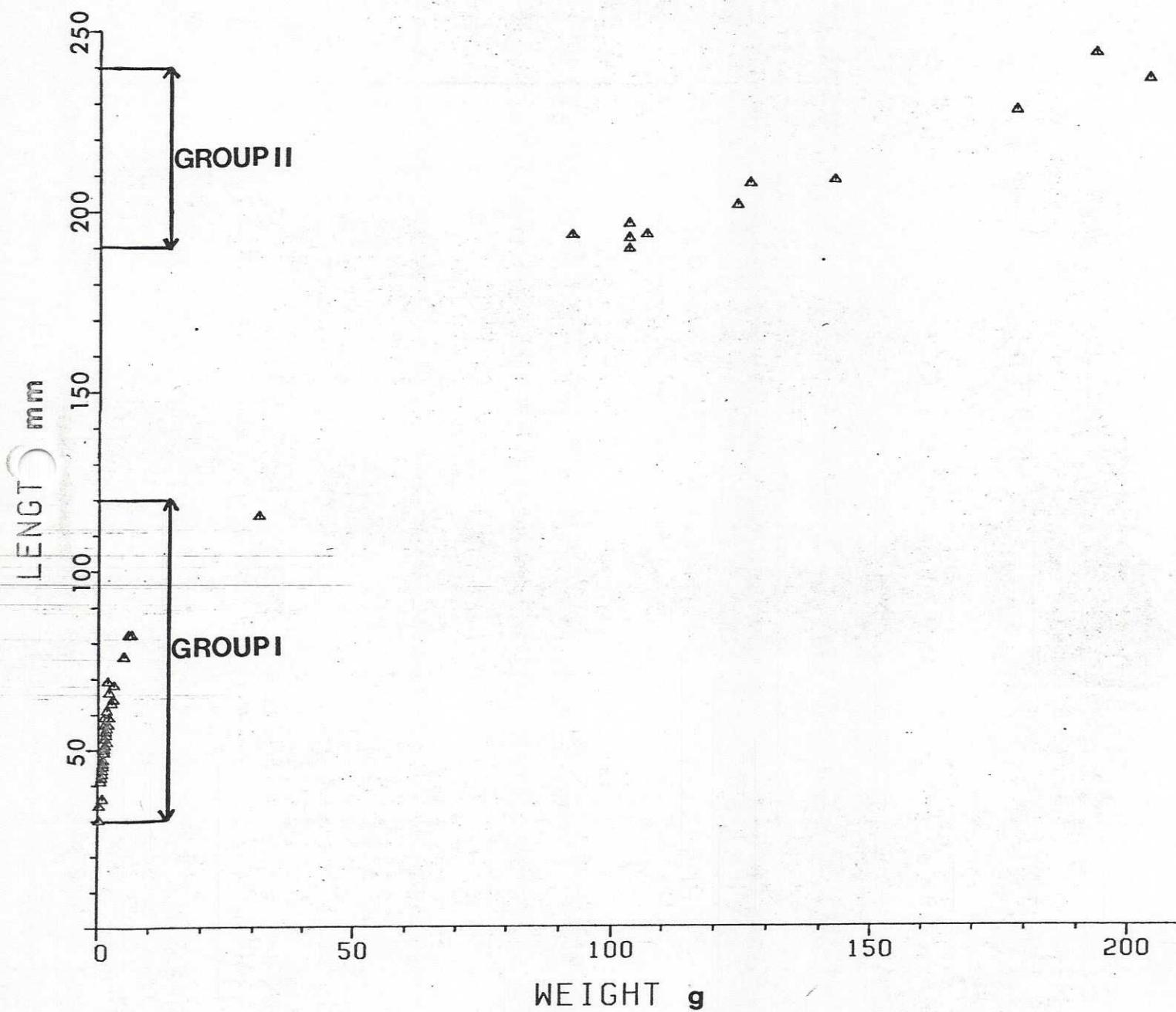
A scatter plot of length versus weight for the Largemouth Bass. The size divisions corresponding to Groups are shown.

Group 1      30-120 mm

Group 2      190-240 mm



## LARGEMOUTH BASS



LARGEMOUTH BASS

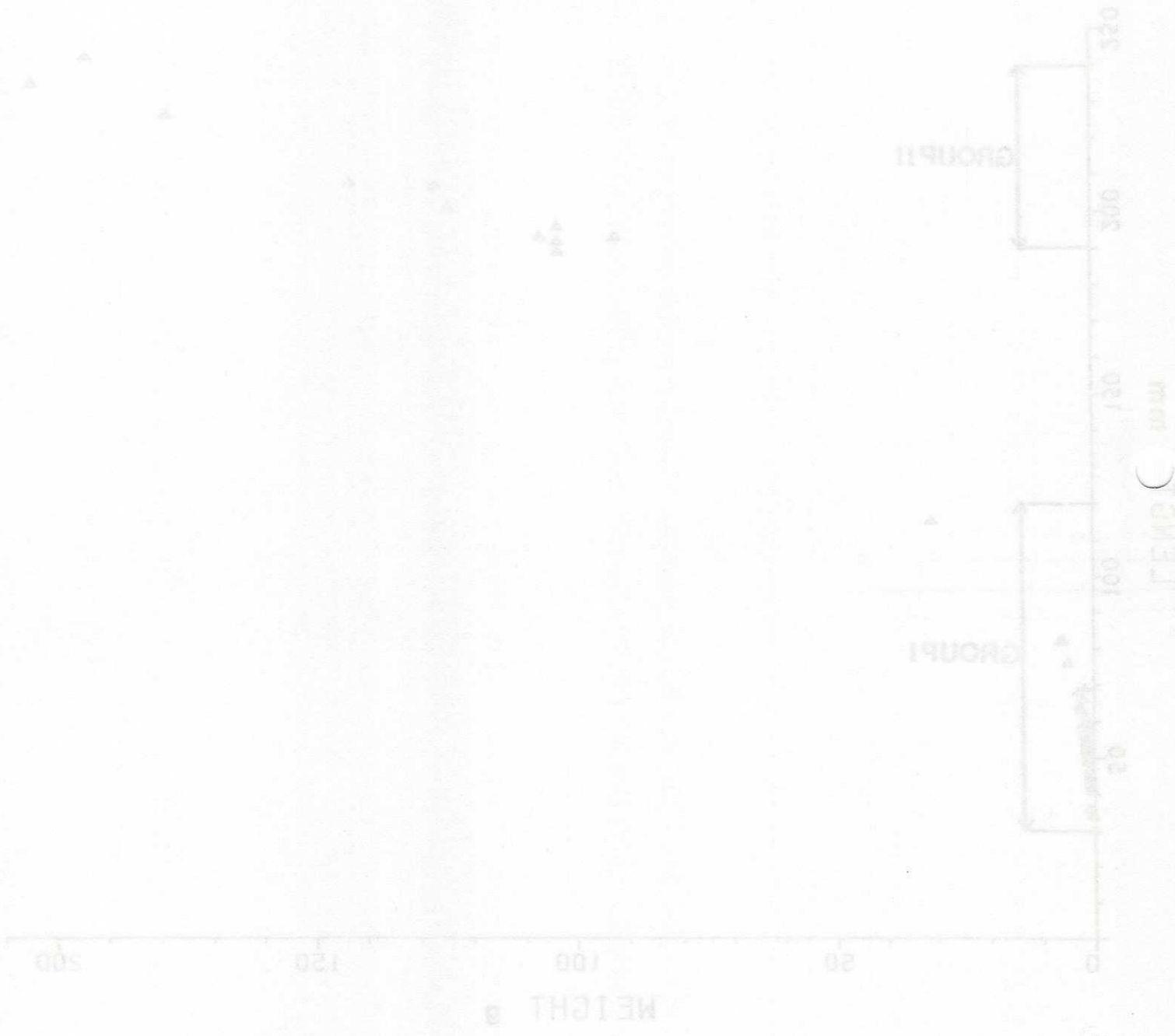


Figure 30:

The size of the largest number base. The size of each slice represents the percent volume contribution of each prey taxon to the total stomach contents. The percentage numbers are the mean number of prey items this would represent.

The sample size is shown for each diagram.

- 1 cladocerans
- 2 copepods/nauplii
- 3 chironomid larvae
- 4 detritus
- 5 gammarid amphipods
- 6 cyclopoid nauplii
- 7 ephemeropteran nymphs
- 8 hexagenid nymphs
- 9 trichopteran larvae
- 10 viviparus
- 11 amphipods
- 12 isopods
- 13 terrestrial insects
- 14 fish
- 15 animal tissue
- 16 plant tissue
- 17 organic debris
- 18 other

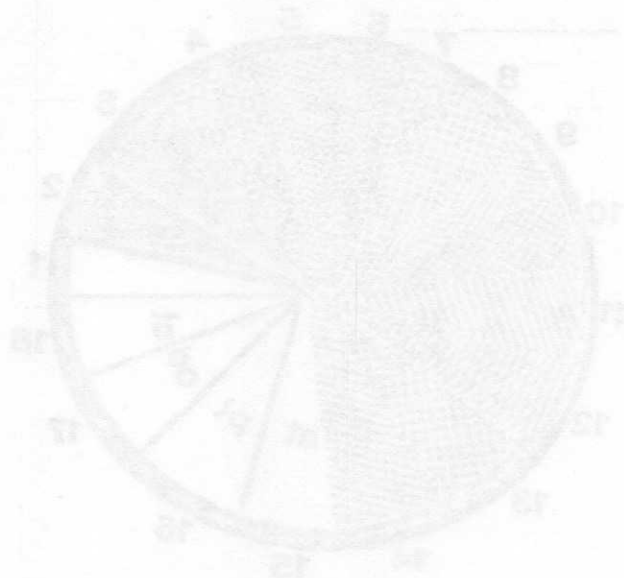
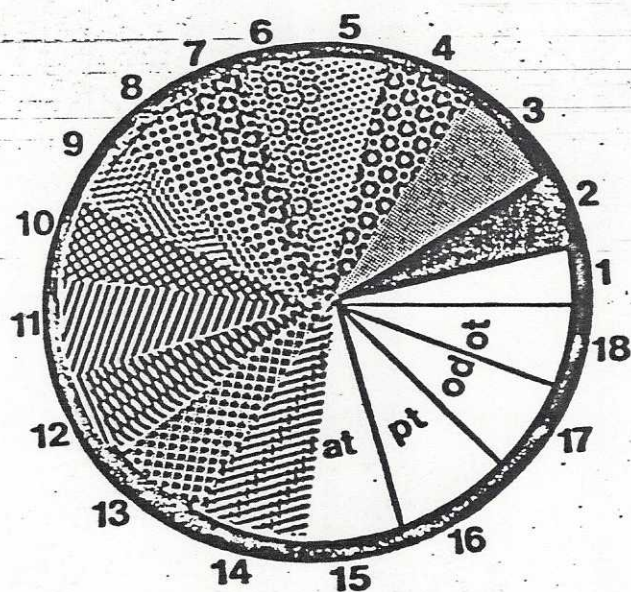


Figure 30:

The diet of the Largemouth Bass. The size of each slice represents the percent volume contribution of each prey taxocene to the total stomach contents. The peripheral numbers are the mean number of prey items this would represent.

The sample size is shown for each diagram.

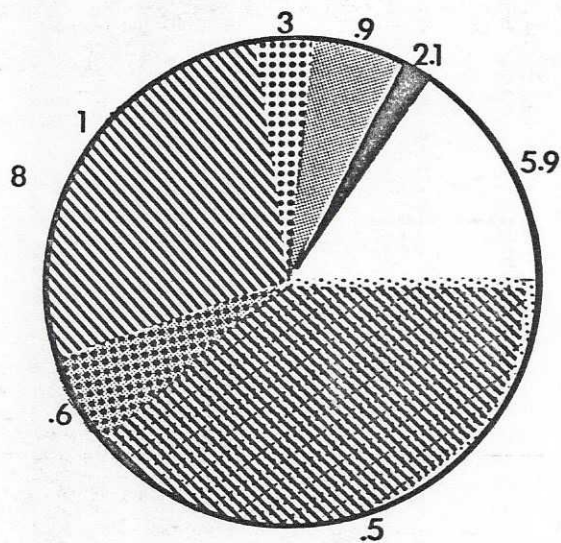
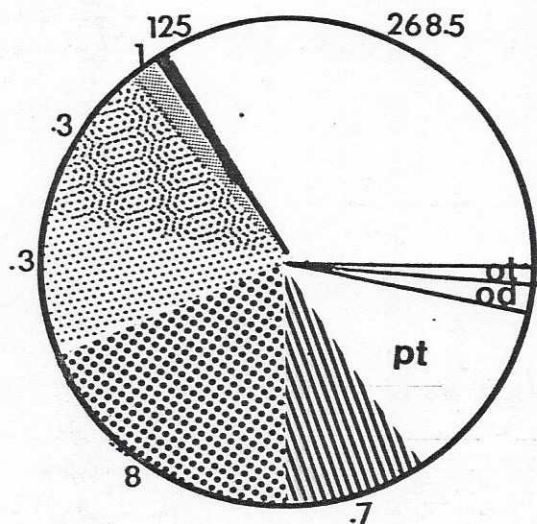


- 1 cladocerans
- 2 copepods/ostracods
- 3 chironomid larvae
- 4 decapods
- 5 anisoptera nymphs
- 6 zygoptera nymphs
- 7 Ephemerella nymphs
- 8 Hexagenia nymphs
- 9 trichopteran larvae
- 10 Viviparus
- 11 amphipods
- 12 hydracarina
- 13 terrestrial insects
- 14 fish
- 15 animal tissue
- 16 plant tissue
- 17 organic debris
- 18 other

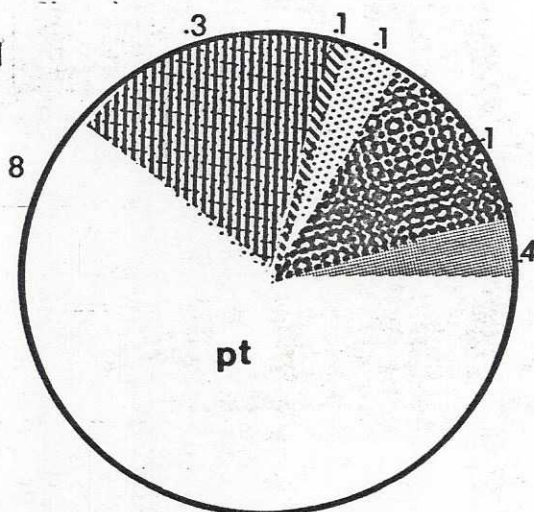
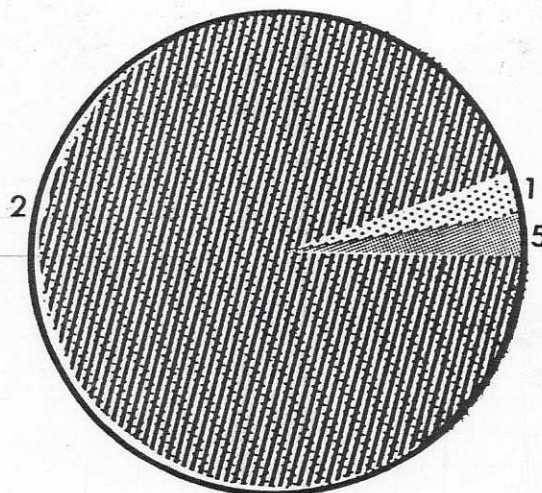


# LARGEMOUTH BASS

**GROUP 1**  
30-120



**GROUP 11**  
190-240



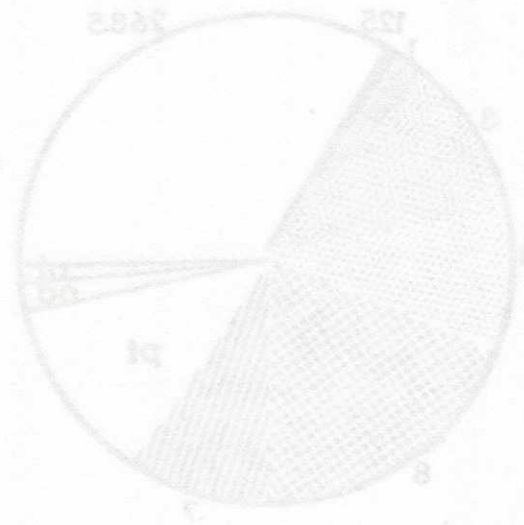
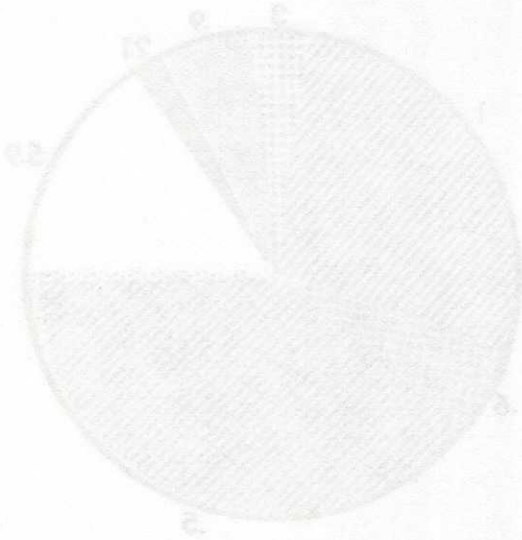
**MAY**

**JULY**

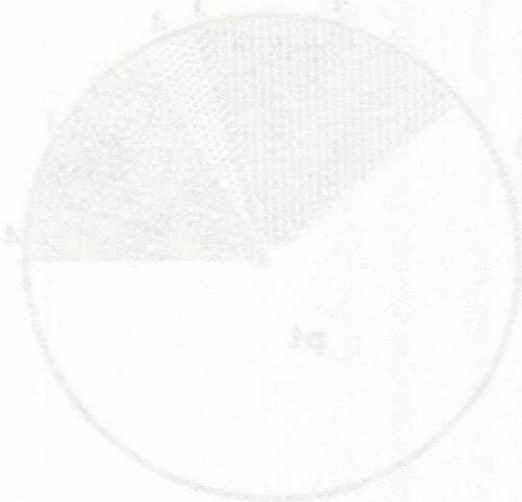


# LARGEMOUTH BASS

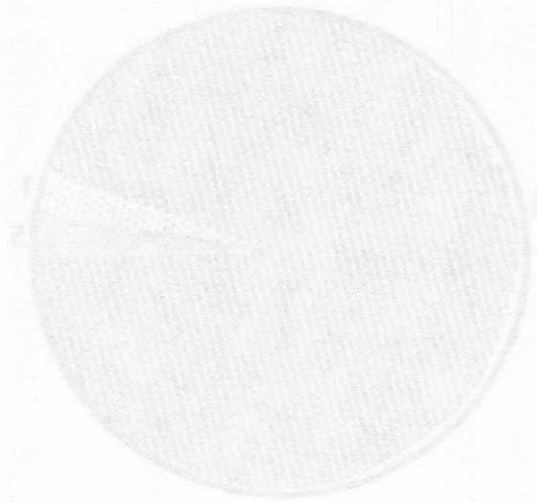
GROUP 1  
30-150



GROUP 11  
150-240



JULY



MAY

96

rates of the largest size that the mouth morphology will permit. From the benthic diet the Largemouth Bass shift quickly into a climax diet of fish. An apparent trend in Sunfish Lake is however, to retain a significant cladoceran and copepod component in the diet for a proportionately longer time than has been recorded for other systems.

#### Smallmouth Bass

(N=2;no analysis)

Two young of the year Smallmouth Bass were caught during September but no stomach content analysis has so far been completed.

#### Iowa Darter

(N=160;group I M=5,J=1:group II M=19,J=3)

Lengths of Iowa Darters show a bimodal distribution so two size categories were distinguished in figures 31 and 32. They are ~~28-40~~ mm and ~~4-54~~ mm. The species thought to have a 2 year life cycle in Southern Ontario, (Winn 1958a in Scott and Crossman 1974). Iowa Darters are present in great numerical abundances in the Chara growth of the littoral zone. One or more Darters were routinely caught in surface ekman samples.

rates of the larvae also show the same tendency with  
 permit. From the benthic diet the large-mouth bass shift  
 quickly into a climax diet of fish. An apparent trend  
 in Canadian Lake is however, to retain a significant  
 cladoceran and copepod component in the diet for a  
 proportionately longer time than has been reported for  
 other systems.

Smallmouth Bass  
 (N=3; no analysis)

Two young of the year Smallmouth Bass were caught  
 during September but no stomach content analysis has as  
 far been completed.

Long Bass  
 (N=10; group 1 N=5, 2-10 group 2 N=5, 3-10)

Lengths of Long Bass show a bimodal distribution  
 as two size categories were distinguished in figures 11  
 and 12. They are 45mm and 105mm. The species thought  
 to have a 3 year life cycle in Southern Ontario, (Winn  
 1958 in Scott and Crossman 1973). Long Bass are  
 present in great numbers throughout in the Great  
 growth of the littoral zone. One of more Bass were  
 routinely caught in surface oxygen samples.

Figure 11

A scatter plot of log10 versus weight for the Iowa Darter. The size divisions

corresponding to Groups are shown.

Group 1 58-60 mm

Group 2 61-64 mm

Figure 31:

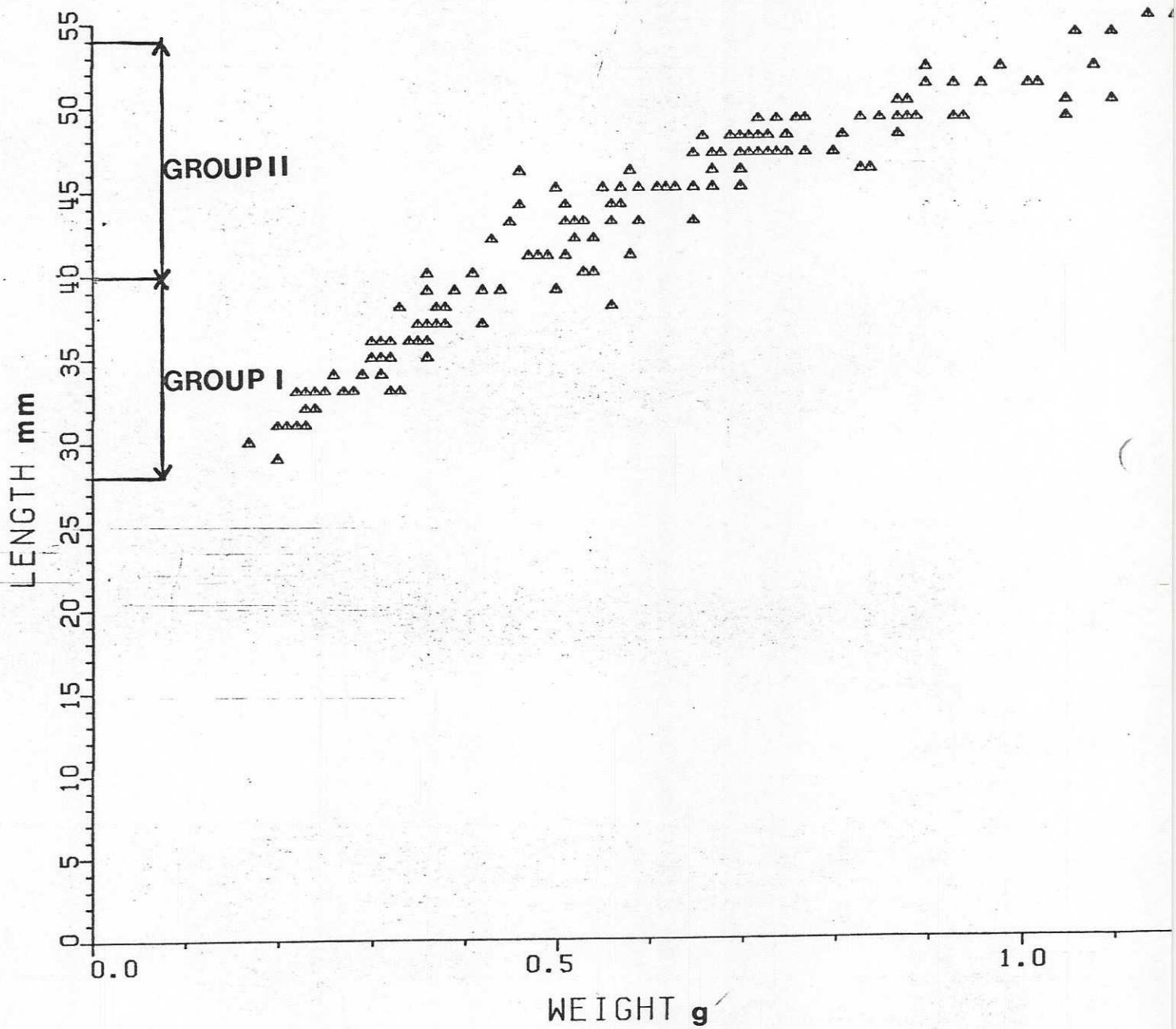
A scatter plot of length versus weight for the Iowa Darter. The size divisions corresponding to Groups are shown.

Group 1      28-40 mm

Group 2      41-54 mm



# IOWA DARTER



IOWA BARTER

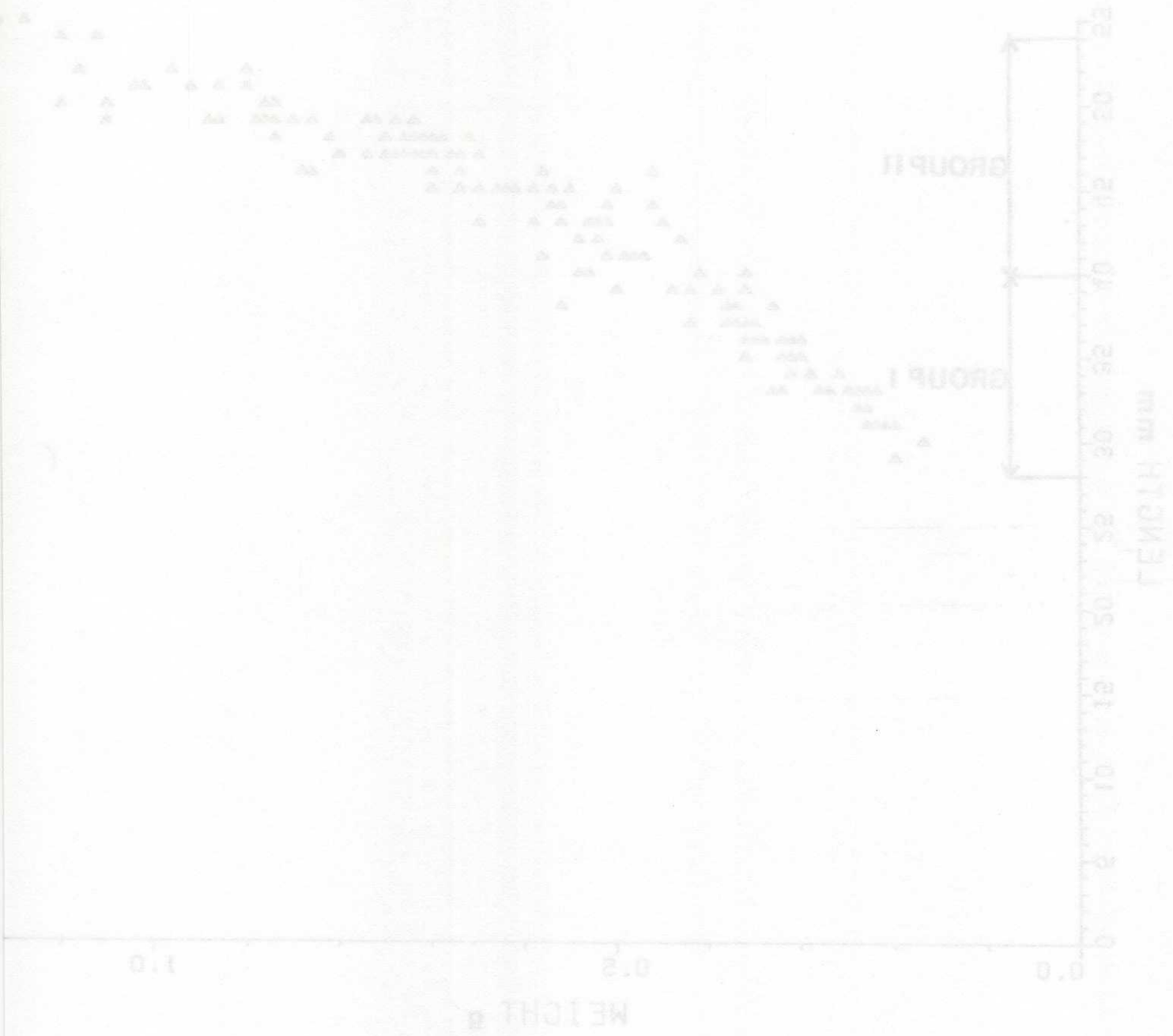


Figure 11:

The diet of the four species. The size of each slice represents the percent volume contribution of each prey category to the total stomach contents. The percentage numbers are the mean number of prey items this would represent. The sample size is shown for each category.

- 1 cladocera
- 2 copepodites/copepods
- 3 chironomid larvae
- 4 diptera
- 5 amphipods
- 6 cyclopoid nauplii
- 7 ephemeroptera nymphs
- 8 hexagenia nymphs
- 9 trichoptera larvae
- 10 virgatus
- 11 amphipods
- 12 hydra
- 13 terrestrial insects
- 14 fish
- 15 animal tissue
- 16 plant tissue
- 17 organic debris
- 18 other

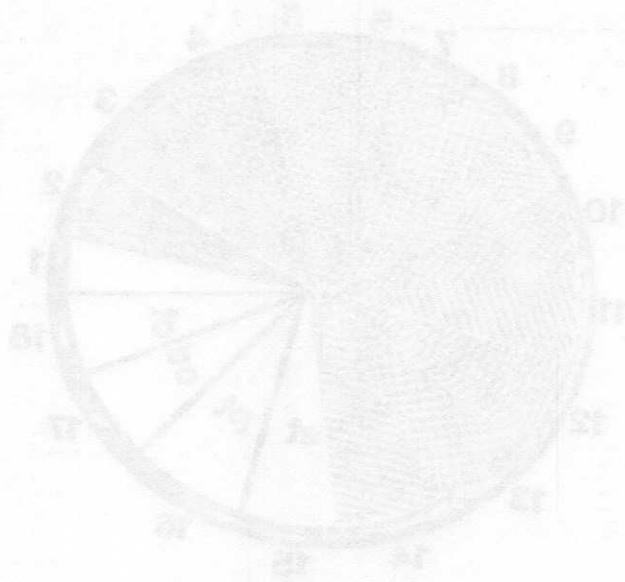
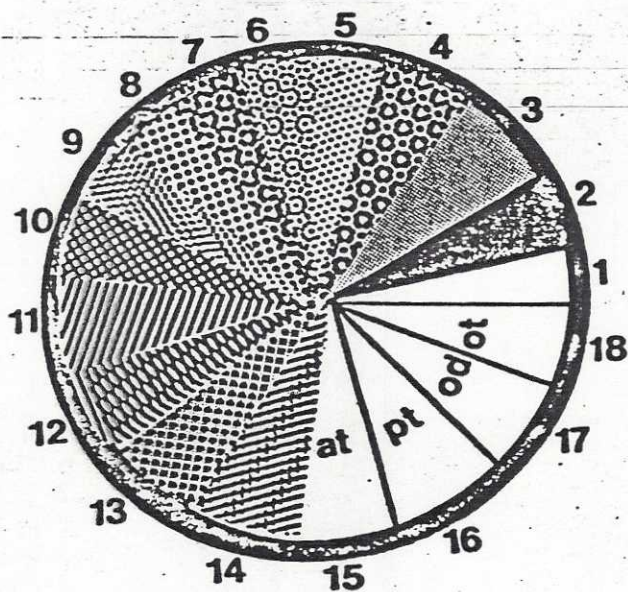


Figure 32:

The diet of the Iowa Darter. The size of each slice represents the percent volume contribution of each prey taxocene to the total stomach contents.

The peripheral numbers are the mean number of prey items this would represent.

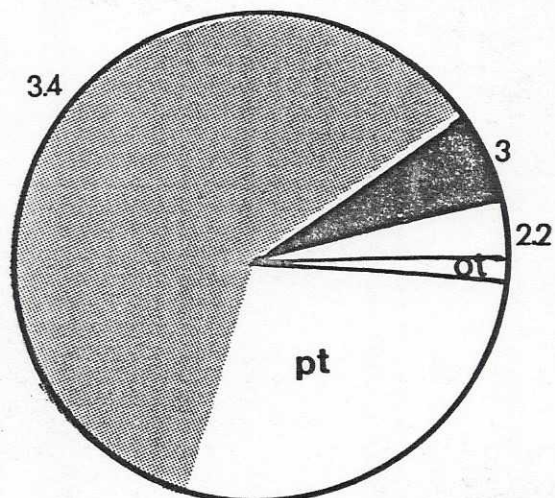
The sample size is shown for each diagram.



- 1 cladocerans
- 2 copepods/ostracods
- 3 chironomid larvae
- 4 decapods
- 5 anisoptera nymphs
- 6 zygoptera nymphs
- 7 Ephemerella nymphs
- 8 Hexagenia nymphs
- 9 trichopteran larvae
- 10 Viviparus
- 11 amphipods
- 12 hydracarina
- 13 terrestrial insects
- 14 fish
- 15 animal tissue
- 16 plant tissue
- 17 organic debris
- 18 other

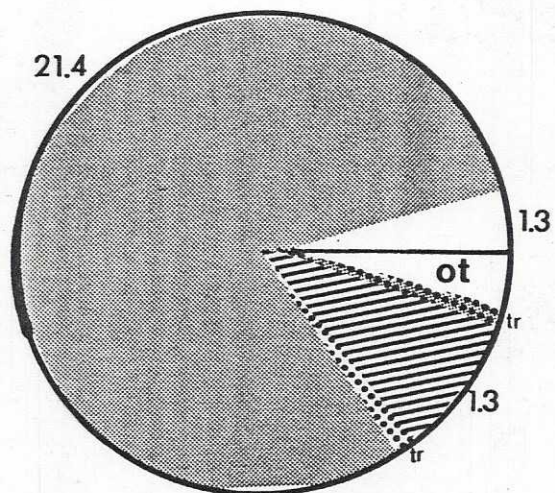
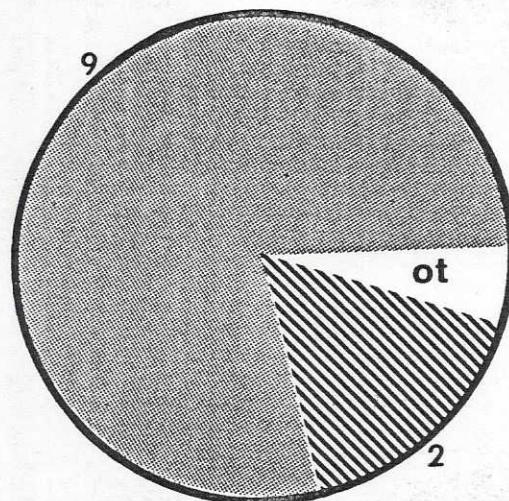


# IOWA DARTER



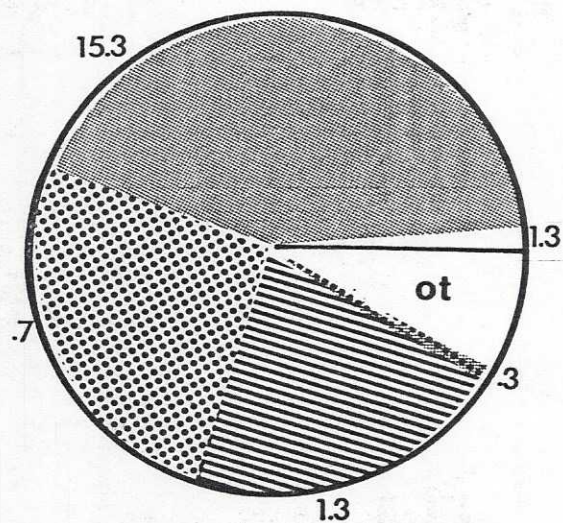
## GROUP 1

28-40 mm  
5 Sample 1  
size



## GROUP 11

41-54 mm  
19 Sample 3  
size



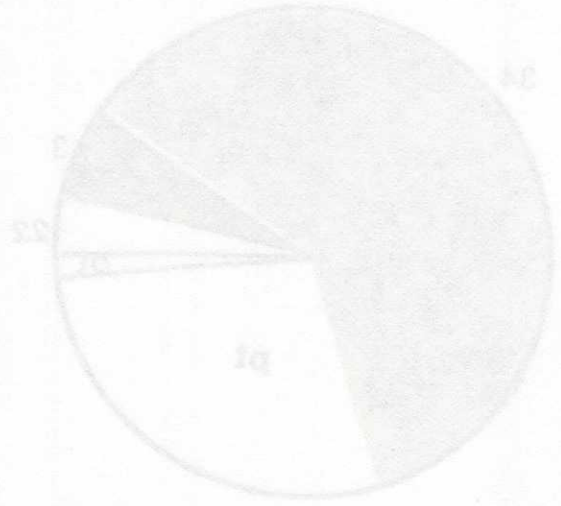
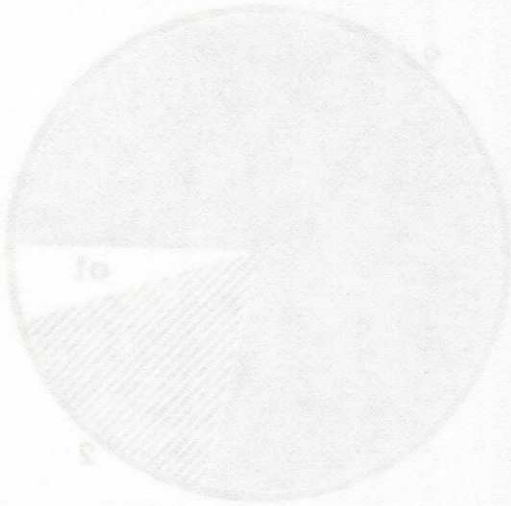
MAY

JULY

# IOWA DARTER

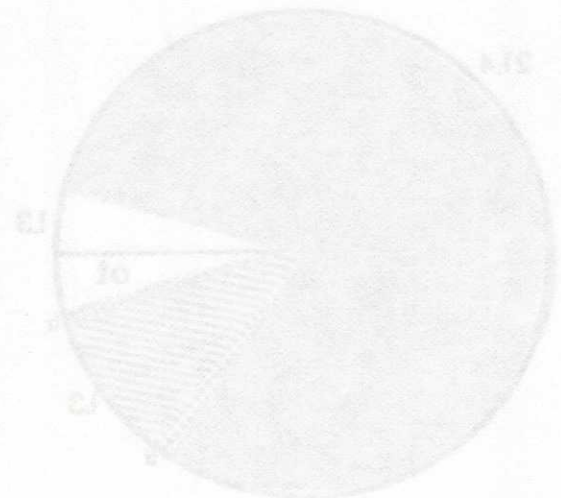
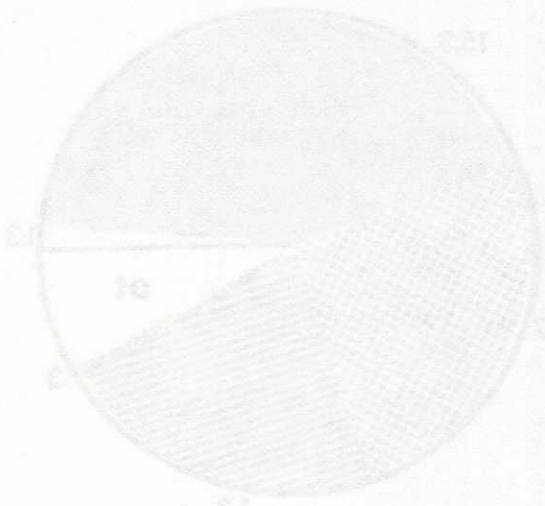
GROUP I

28-40 mm  
2 Sample 1  
also



GROUP II

41-54 mm  
19 Sample 2  
also



JULY

MAY



99

For group I fish the diet is dominated by chironomid larvae (58%). Their importance increases in July (80%) and amphipods contribute secondarily to the bulk (15%). Group II fish depend on chironomid larvae for 79.7% of the stomach volume in May. In June, the diet is still dominated by chironomid larvae (43.4%) but Ephemerella and Hyalella both contribute over 20% of the volume. Cladocera are never particularly important in terms of numbers or volume. This range of diet encompassing Cladocera, chironomid larvae and amphipoda appears to be characteristic of the species (Turner 1921 in Scott and Crossman 1974).

#### Bluntnose Minnow

(N=19:M=14, J=0)

Stomach content analysis for the Bluntnose Minnow (figures 33, 34) are based on fish caught during May. Like the White Sucker, the Minnow has a very small stomach so contents of the gut to the first major constriction were considered. Even so, many of the stomachs were empty. the majority of the stomach bulk consisted of organic detritus (63.2%). Minimal numbers of Cladocera (5%) and chironomids (7.8%) were found. This reflects the food habits described by Keast and Webb (1966) relative to the inferior mouth position.

But group 1 fish the diet is dominated by chironomid larvae (58%). Their importance increases in July (88%) and amphipods contribute especially to the bulk (15%). Group II fish depend on chironomid larvae for 75.7% of the stomach volume in May. In June, the diet is still dominated by chironomid larvae (45.4%) but *Ephemeroptera* and *Hydrilla* both contribute over 3% of the volume. Cladocera are never particularly important in terms of numbers or volume. This range of diet encompassing cladocera, chironomid larvae and amphipods appears to be characteristic of the species (Turner 1931 in Scott and Crossman 1974).

#### Stannoside Minnow

(N=13; M=14, J=8)

Stomach content analysis for the Stannoside Minnow (figures 33, 34) are based on fish caught during May. Like the White Ecker, the Minnow has a very small stomach so contents of the gut to the first major constriction were considered. Even so, many of the stomachs were empty. The majority of the stomach bulk consisted of organic detritus (41.3%). Minimal numbers of cladocera (2%) and chironomids (7.3%) were found. This reflects the food habits described by Keast and Webb (1958) relative to the inferior mouth position.



Figure 33:

A scatter plot of length versus weight for the Minnesota Minnesota. No size

groups were distinguished.

Group 1 40-50 mm

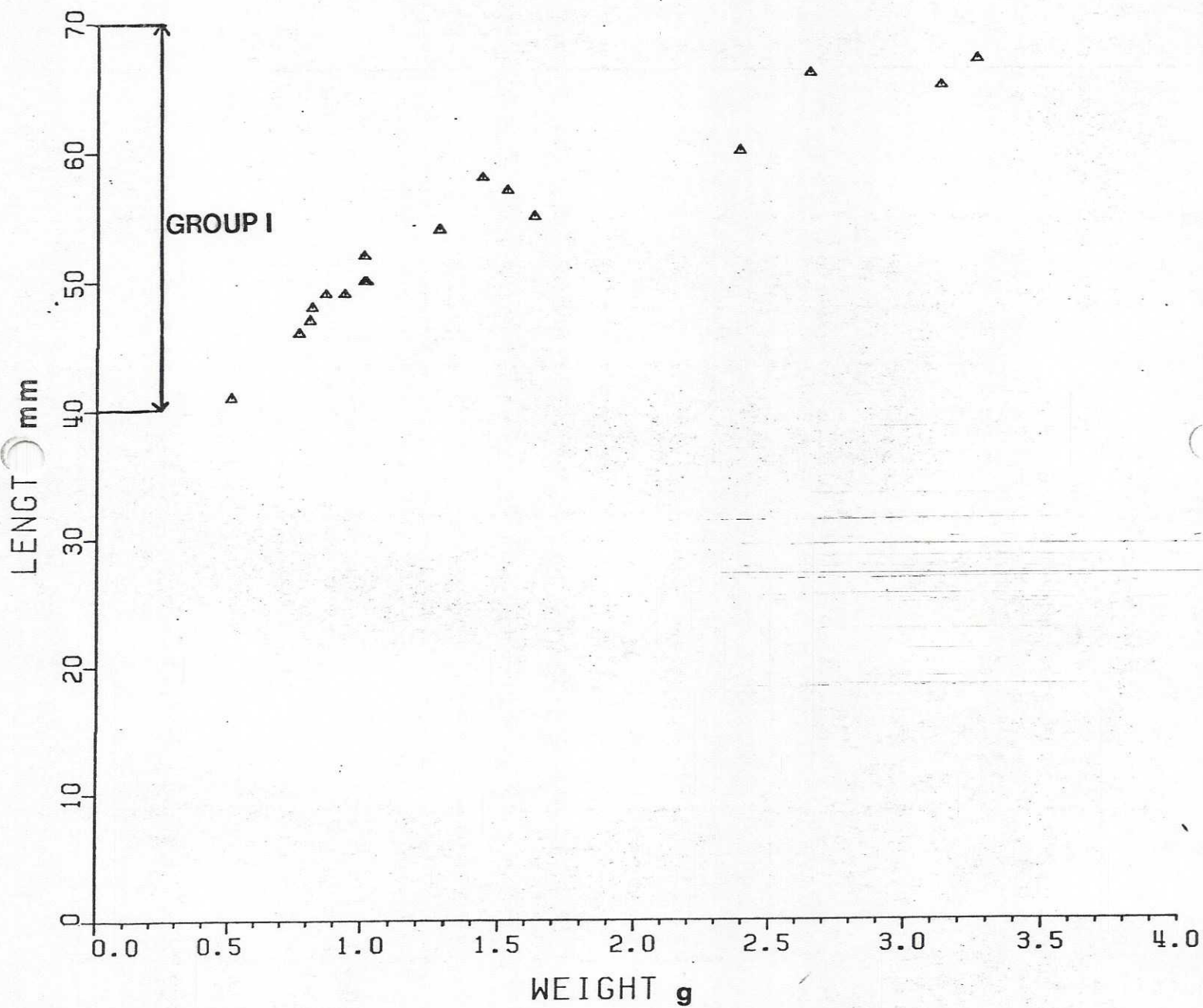
Figure 33:

A scatter plot of length versus weight for the Bluntnose Minnow. No size groups were distinguished.

Group 1      40-70 mm

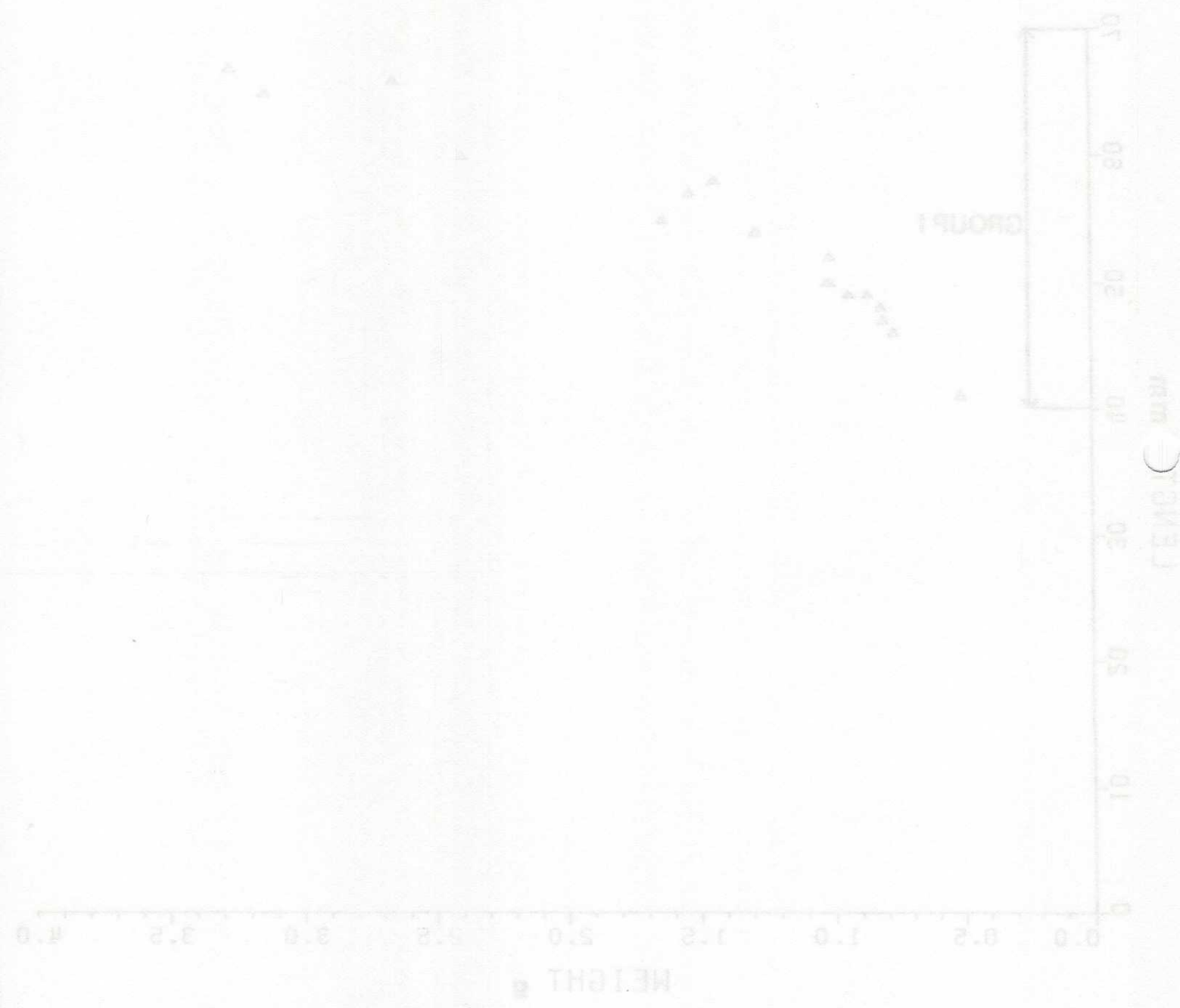


# BLUNTNOSE MINNOW



BLUNTNOSE  
MINNOW

GROUP 1



## Brook Stickleback

(N=2: M=2, J=0)

Figures 35 and 36 show the stomach contents of two Sticklebacks caught during May. Cladocerans are the most important food item by bulk (50%) while ostracods and copepods are numerically the most abundant (1002 individuals per stomach). Chironomid larvae (15%), amphipods (11%), and organic matter (10%) make up the remainder of the diet. This diet indicates a greater emphasis on feeding in the water column (Cladocera and ostracods) than was reported by Dymond (1926) or Rickler (1932) (both in Scott and Crossman 1974) although ostracods are listed as an important dietary item in Lake Nipigon.

## Brown Bullhead

(N=1: M=1, J=0)

Only one individual was caught in the course of sampling. It was relatively large (196 mm, 984 g) and was probably in its fourth summer based on growth rates in Scott and Crossman (1974). 45% of the stomach volume consisted of Cladocera, 30% of animal tissue, 20% of terrestrial insects and 5% of chironomids (figure 36). The bullhead is generally a nocturnal, chemosensory feeder (Keast 1967) and feeds on a very wide variety of



Brown Bullheads  
(W-2: M-2, J-2)

Figures 32 and 33 show the stomach contents of two  
Bullheads caught during May. Cladocerans are the  
most important food item by bulk (50%) while ostracods  
and copepods are numerically the most abundant (1800  
individuals per stomach). Chironomid larvae (120),  
amphipods (110), and organic matter (100) make up the  
remainder of the diet. This diet indicates a greater  
emphasis on feeding in the water column (cladocerans and  
ostracods) than was reported by Dymond (1936) or Bickler  
(1933) (both in Scott and Crossman 1973) although  
ostracods are listed as an important dietary item in  
Lake Michigan.

Brown Bullheads  
(W-1: M-1, J-1)

Only one individual was caught in the course of  
sampling. It was relatively large (130 mm, 900 g) and  
was probably in its fourth summer based on growth rates  
in Scott and Crossman (1974). 45% of the stomach volume  
consisted of cladocerans, 30% of animal tissue, 20% of  
terrestrial insects and 5% of chironomids (Figure 32).  
The bullhead is generally a nocturnal, chemosensory  
feeder (Kest 1967) and feeds on a very wide variety of