ESTIMATES OF FINFISH COMMUNITY STRUCTURE IN A MANGROVE LAGOON: TRAPS VERSUS VISUAL TRANSECTS

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ABSTRACT

A mangrove lagoon fringing prop root habitat was sampled monthly with traps and visual transects from July 1993 to April 1995. 20 species were observed in trap samples. The families in highest abundance in trap samples were gerreidae, lutjanidae, and pomadasyidae. Length frequencies were skewed toward small individuals for all species. 31 species were observed in transect samples. Gerreidae, lutjanidae, pomadasyidae, engraulidae and clupeidae were the most abundant families. Visual transects provide better estimates of species composition and abundance, even in moderate visibility conditions (≤ 3 m visibility) of mangrove lagoons. Trap sampling provided accurate estimates of the size structure for many species. Used simultaneously, trapping and visual transects allow an accurate assessment of mangrove lagoon fish communities.

Introduction

Mangrove lagoons are an important habitat for juveniles of many fish species (Cintron-Molero, 1987; Thayer et al., 1987; Boulon, 1992), and can provide nursery areas for estuarine as well as reef fishes (Odum et al., 1982; Boulon, 1992). The mangrove prop-root habitat is important for many reasons. Many juveniles use detritus and mangrove-associated invertebrates and fish as a food source (Zieman et al,. 1984; Thayer et al., 1987). The complex prop-root habitat may also provide protection from predation (Orth et al., 1984; Sogard and Olla, 1993). Furthermore, in addition to providing important habitat, mangroves filter terrigenous sediment and help maintain the integrity of the lagoon seagrass habitat (Cintron-Molero, 1987), also an important nursery area (Dennis, 1992).

Mangrove habitat in the U.S. Virgin Islands is primarily mangrove fringe along lagoons and oceanic bays (Boulon, 1992). On St. Croix, the southern-most of the U.S. Virgin Islands, the fringing mangroves have a well developed, permanently submerged prop-root system that provides potential nursery habitat. There are three prominent mangrove systems on St. Croix: Salt River, Altona Lagoon and Great Pond. This study was designed to quantitatively measure finfish utilization of the mangrove prop-root habitat of St. Croix.

This manuscript addresses results from the concurrent utilization of two sampling methods in Altona Lagoon.

Methods and Materials

Site Description:

Altona Lagoon is a semi-enclosed mangrove-fringed lagoon on the north shore of St. Croix, U.S.V.I., connected to a backreef area through a single narrow (10 m width) channel. Mangroves grow along the shoreline of the lagoon only.

Field Sampling:

The mangrove prop-root habitat of Altona Lagoon was sampled monthly with standardized fish traps and visual transects over a 22 month period (July 1993 - April 1995). The project is scheduled to continue for an additional 8 months (through December 1995).

The total mangrove fringing shoreline was partitioned into four sample areas, two near the channel entrance and two near the terminal end of the lagoon. Each area was sampled over a twenty-four hour period with twelve standardized rectangular fish traps, 92 cm x 57 cm x 19 cm, made from vinyl-coated 1.3 cm wire mesh, baited with herring. For each area, ten traps were set at 50 m intervals along the mangrove fringe, and two traps were set in the lagoon interior at least 50 m from the shoreline. All four areas were sampled within a five day sampling period each month. All individuals caught in the traps were identified, enumerated, measured (fork length and total length), and returned to the capture site.

The mangrove fringe of two areas was also sampled with visual transects. In each area, two snorkelers completed four transects 100 m x 3 m. All transects were completed on the morning traps were set in the area being sampled to avoid removal of fish due to trapping activities. The number of adults and juveniles of each species were recorded for each transect.

Analyses:

Only the data from the two areas sampled by both trap and visual transects was analyzed for this report. Preliminary analyses were primarily qualitative. Rigorous quantitative analyses will be conducted upon completion of the project. Inter-area abundance levels for the six most abundant species were examined with a Mann-Whitney U test.

RESULTS

A total of 20 species were caught in traps and 31 species were observed in transects (Table 1). Each method revealed *Gerres cinereus* to be the most abundant species, followed by *Eucinostomus jonesi* (fig. 1). All other species were in much lower abundance.

In the trap samples, *E. jonesi* ($Z = 36.430$, $p < 0.05$, $df = 1$) and *Lutjanus apodus* ($Z = 28.620$, $p < 0.05$, $df = 1$) abundance differed between area 1 and area 2 (fig. 1a). In transect samples, *E. jonesi* ($Z = 3.371$, $p < 0.05$, $df = 1$), *L. apodus* ($Z = 3.526$, $p < 0.05$, $df = 1$), *Haemulon flavolineatum* ($Z = 6.430$, $p < 0.05$, $df = 1$), and *Sphyraena barracuda* ($Z = 2.204$, $p < 0.05$, $df = 1$) abundances differed between area 1 and area 2 (fig. 1b).

There was no apparent seasonal trend in abundance of fishes in trap samples (fig. 2). However, there appeared to be a peak in abundance in transect samples in August of both 1993 and 1994. This was due to an increase in the abundance of members of the clupeidae and engraulidae families.

All species recorded in trap samples were dominated by small individuals. *G. cinereus* (fig. 3), *E. jonesi* (fig. 4), and *L. apodus* (fig. 5) typify the size distribution of most species.

DISCUSSION

The difference in number of species recorded by the different sampling methods shows a bias associated with the use of baited traps. Many species are not susceptible to traps. For example, the baitfishes, members of the clupeidae and engraulidae families, were abundant sporadically in transects but were not caught in traps. Herbivores were also not represented in trap samples. In addition, some species which were recorded in trap samples (e.g., bucktooth parrotfish) were under-represented. Thus, according to results from the trap samples the mojarras were the major species, with all other species in very low abundance. While the same general trend occurs in the transect results, the drop in relative abundance from the mojarras to all other species is not quite as drastic. Finally, transects were more likely to record incidental species or species in low abundance.

Visual transects provided the better estimate of species composition and abundance, while trap samples provided more accurate estimates of the size structure of the abundant species.

Accurate estimates of size of individual fish was not possible in the visual transects. While it was possible to estimate minimum, maximum and mean lengths of observed species, the fishes were too active and too numerous to estimate individual lengths. The trap samples allowed us to obtain measurements of the species which were susceptible to trapping, which turned out to be the most abundant species. This data provided an accurate estimate of the size structure of these species, all of which suggest a population dominated by juveniles. Estimates of juvenile versus adult abundance from transects show similar results.

The abundance of juvenile fishes is common for mangrove lagoons (Odum et al., 1982; Cintron-Molero, 1987; Thayer et al., 1987; Boulon, 1992). While these size distributions are expected, it is important that the mangrove lagoons of St. Croix are documented as important nursery areas.

Utilizing two methods concurrently has allowed us to build a more complete picture of the finfish community structure than from either method alone. Visual transects provided an accurate estimate of species composition and abundance, while trap samples provided accurate measurements of the size structure of the most abundant species.

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Literature Cited

Boulon, R. H. 1992. Use of mangrove prop root habitats by fish in the northern U. S. Virgin Islands. Proc. Gulf Carib. Fish. Inst. 41:189-204.

Cintron-Molero, G. 1987. Caribbean mangroves: a manager's guide. Government of the U. S. Virgin Islands, DPNR, Div. Fish Wildl. 21 p.

Dennis, G.D. 1992. Island mangrove habitats as spawning and nursery areas for commercially important fishes in the Caribbean. Proc. Gulf Carib. Fish. Inst. 41:205-225.

Odum W.E., C.C. McIvor and T.J. Smith III. 1982. The ecology of the mangroves of south Florida: a community profile. U. S. Fish Wildl. Serv. FWS/OBS-81/24. 144p.

Orth, R. J., K.L. Heck and L. van Montfrans, Jr. 1984. Faunal communities in seagrass beds: a review of the influence of plant structure and prey characteristics on predator-prey relationships. Estuaries 7:339-350.

Sogard, S.M. and B.L. Olla. 1993. The influence of predator presence on utilization of artificial seagrass habitats by juvenile walleye pollock, Theragra chalcogramma. Environ. Biol. Fishes 37:57-65.

Thayer, G.W., D.R. Colby and W.F. Hettler, Jr. 1987. Utilization of the red mangrove prop root habitat by fishes in south Florida. Mar. Ecol. Prog. Ser. 35:25-38.

Zieman, J.C., S.A. Mack and A.L. Mills. 1984. Role of seagrasses and mangroves in estuarine food webs: temporal and spatial changes in stable isotope composition and amino acid content during decomposition. Bull. Mar. Sci. 35:380-392.

Table 1. Species observed in Altona Lagoon. + denotes the species was recorded by this sample method.

Species Name	Traps	Transects
Gerres cinereus	+	+
Eucinostomus jonesi	+	+
Lutjanus apodus	+	+
L. griseus	+	+
L. synagris	+	
L. joco	+	
Ocyurus chrysurus	+	
Haemulon flavolineatum	+	+
H. sciurus	+	+
H. carbonarium		+
H. aurolineatum		+
Chaetodon capistratus	+	+
Caranx spp.	+	+
Calamus pennatula	+	+
Sphyraena barracuda	+	+
Megalops atlanticus		+
Stegastes leucostictus		+
Scarus taeniopterus		+
Sparisoma aurofrenatum		+
S. rubripinne		+
S. radians	+	+
S. chrysopterum		+
Halichoeres maculipinna		+
Bothus lunatus	+	
Diodon holocanthus		+
D. hystrix		+
Sphoeroides testudineus	+	+
Aluterus scriptus	+	+
Gymnothorax funebris	+	
Mugil curema		+
Archosargus rhomboidalis		+
Aulostomus maculatus		+
Labrisomus nuchipinnis	+	+
Clupeidae, Engraulidae		+

FIGURE LEGENDS

Figure 1a. Mean abundance of the six most abundant species recorded in transect samples. * denotes significant difference in mean abundance between areas (U, p listed in text).

Figure 1b. Mean abundance of the six most abundant species recorded in trap samples. * denotes significant difference in mean abundance between areas (U, p listed in text).

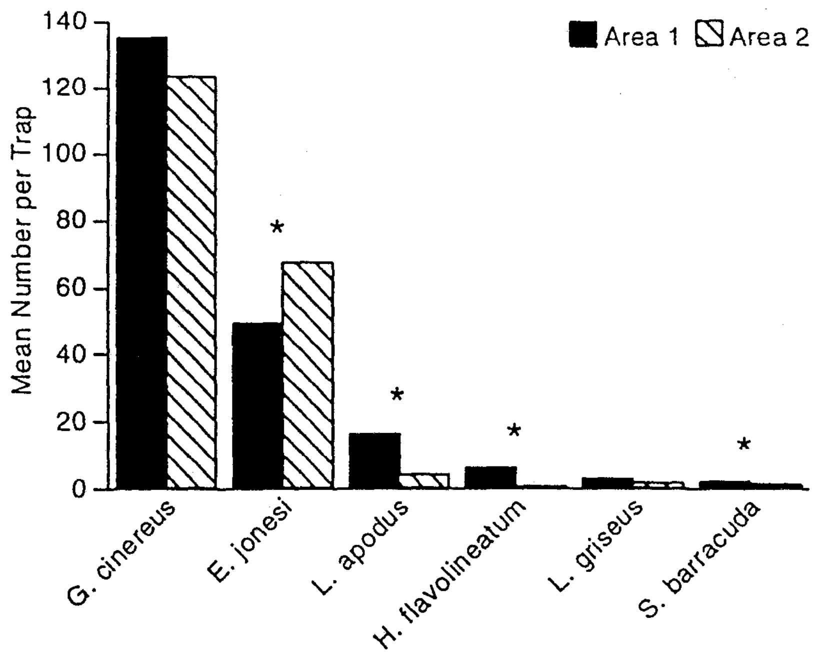
Figure 2. Mean abundance in trap and transect samples by month. Transect abundance on left Y axis, trap abundance on right Y axis.

Figure 3. Length-frequency histogram of *G. cinereus*. Trap data only.

Figure 4. Length-frequency histogram of *E. jonesi*. Trap data only.

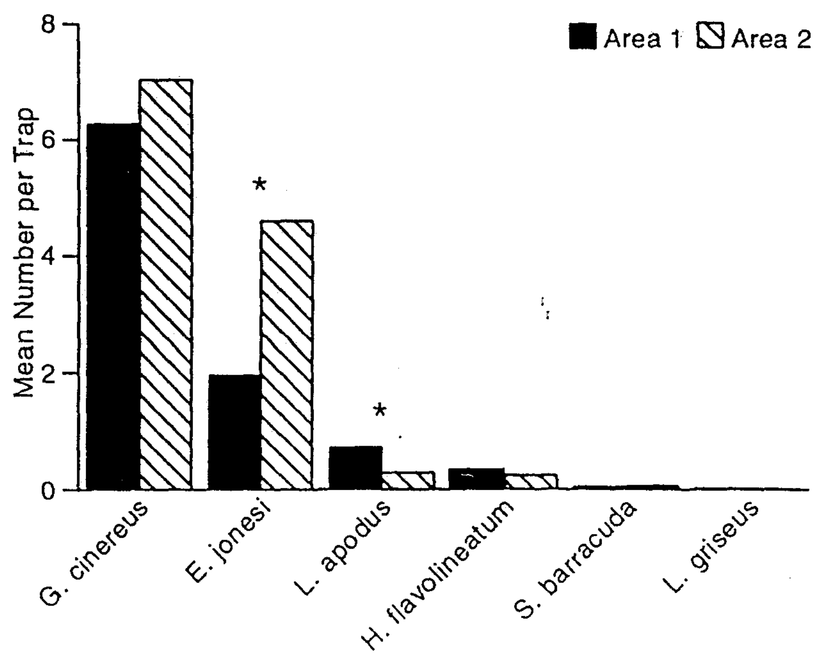
Figure 5. Length-frequency histogram of *L. apodus*. Trap data only.

a)

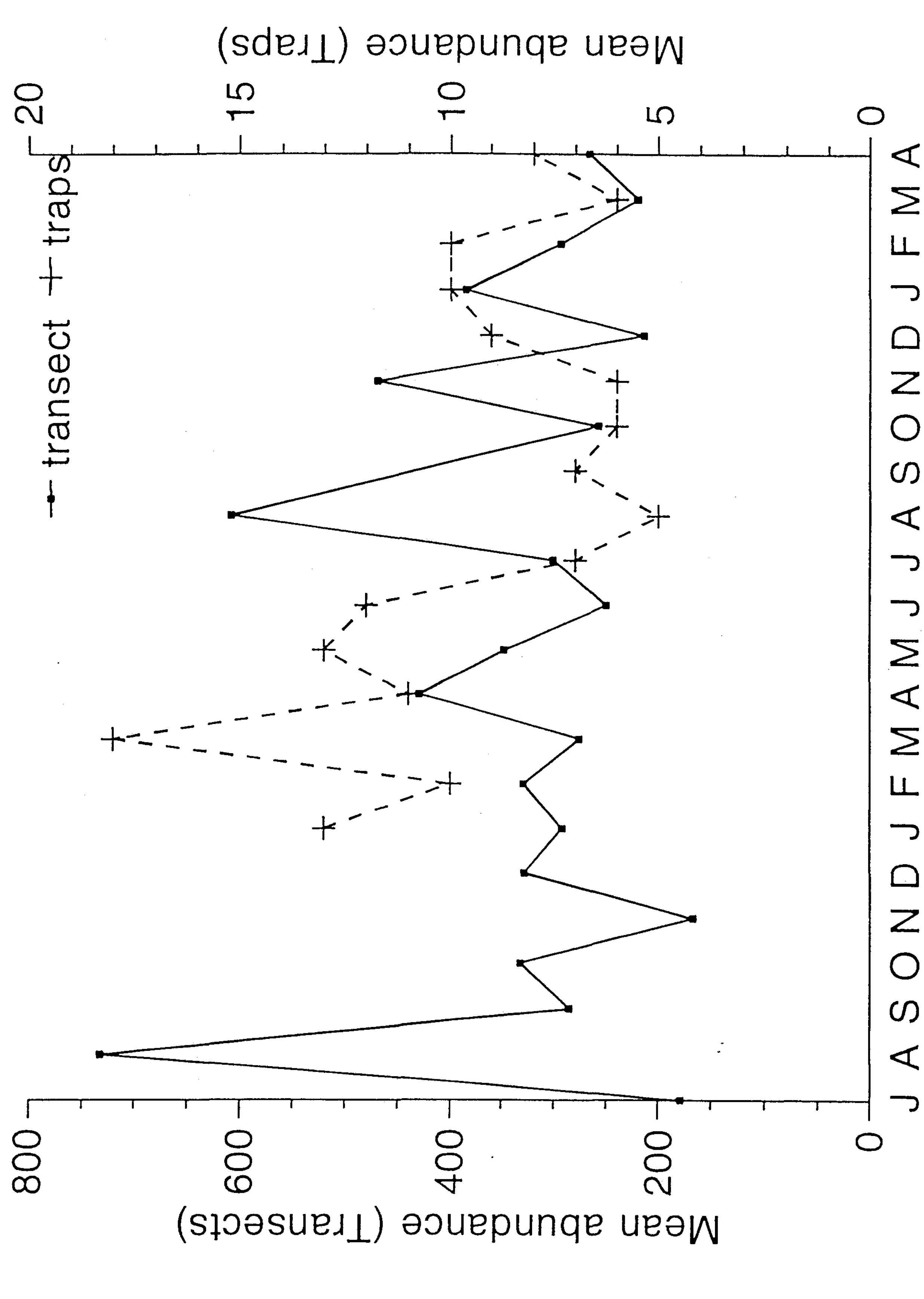


Area 1
Area 2
Mean Number per Trap
0
20
40
60
80
100
120
140
G. cinereus
E. jonesi
L. apodus
H. flavolineatum
L. griseus
S. barracuda
*

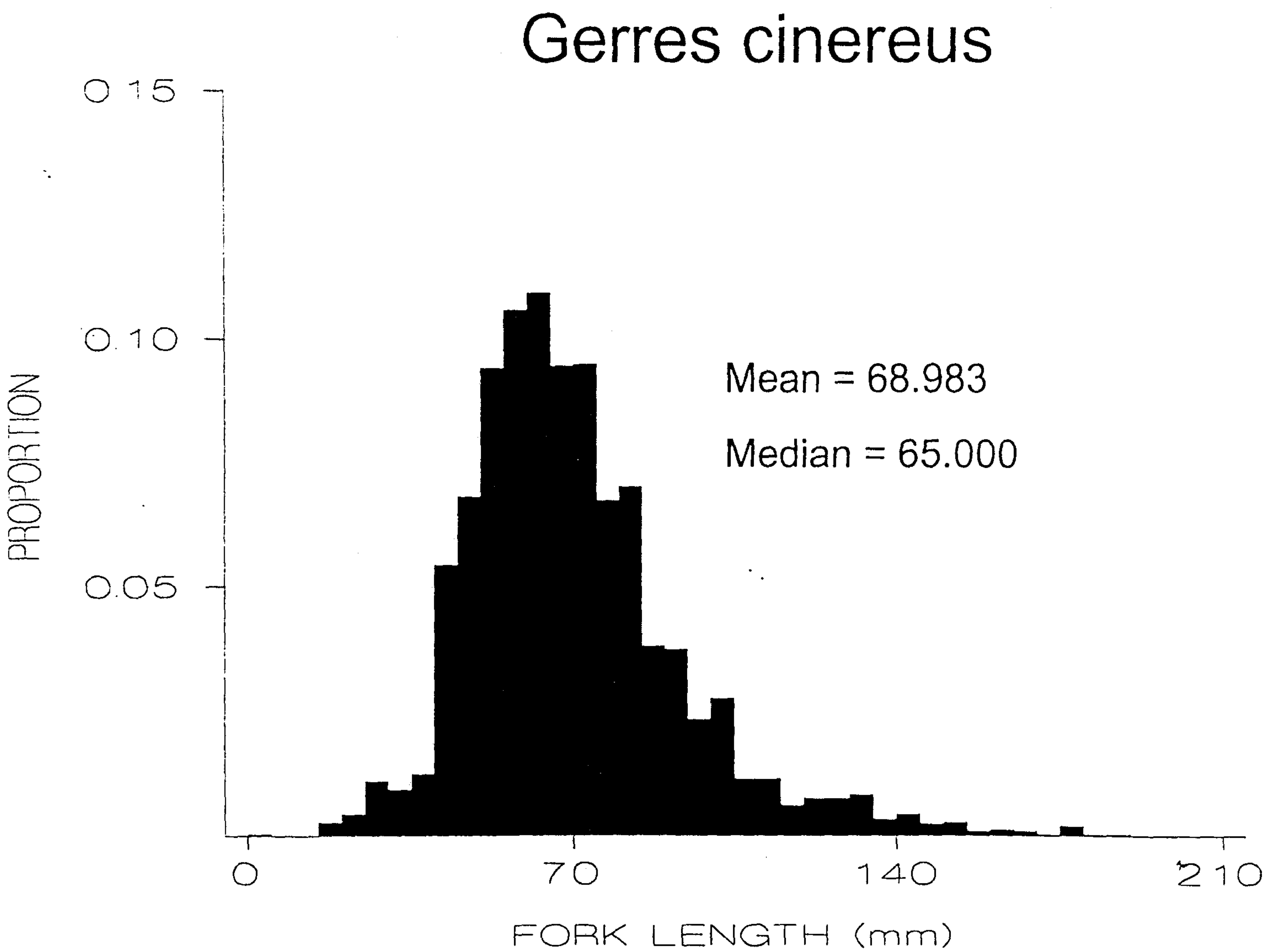
b)

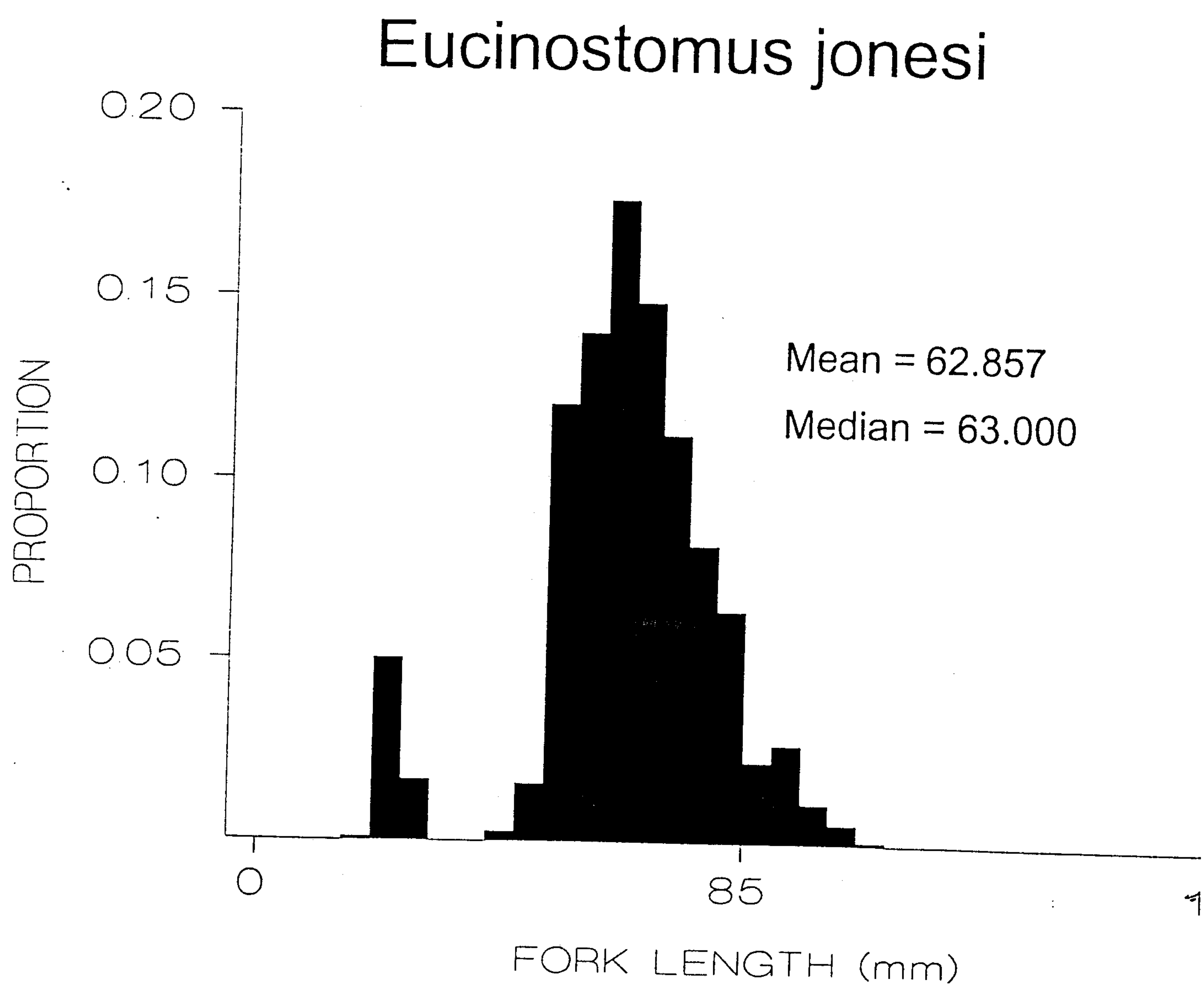


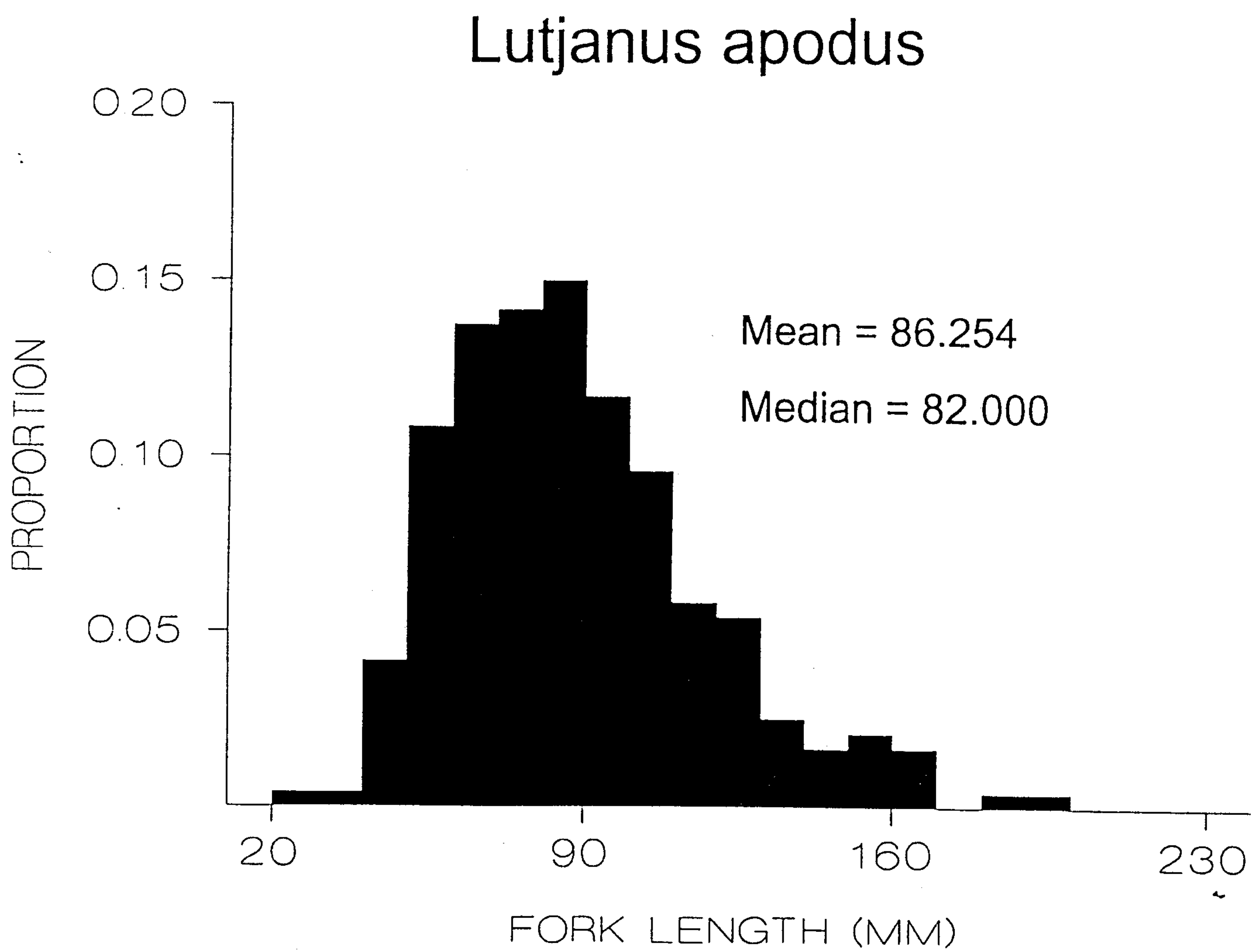
Area 1
Area 2
Mean Number per Trap
0
2
4
6
8
G. cinereus
E. jonesi
L. apodus
H. flavolineatum
S. barracuda
L. griseus
*



Mean abundance (Transects)
Mean abundance (Traps)
transect
traps
0
200
400
600
800
0
5
10
15
20
J A S O N D J F M A M J J A S O N D J F M A


Gerres cinereus
0.15
0.10
0.05
PROPORTION
Mean = 68.983
Median = 65.000
0
70
140
210
FORK LENGTH (mm)


Eucinostomus jonesi
0.20
0.15
0.10
0.05
PROPORTION
Mean = 62.857
Median = 63.000
0
85
FORK LENGTH (mm)


Lutjanus apodus
0.20
0.15
0.10
0.05
PROPORTION
Mean = 86.254
Median = 82.000
20
90
160
230
FORK LENGTH (MM)