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DEFINING THE ECOLOGICAL LIGHT COMPENSATION POINT FOR SEAGRASSES HALODULE WRIGHT11 AND SYRINGODIUM FILIFORME FROM LONG-TERM SUBMARINE LIGHT REGIME MONITORING IN THE SOUTHERN INDIAN RIVER.

Between March 1987 and September 1990 we measured the attenuation of photosynthetically active radiation (PAR) in a shallow system of coastal lagoons at the southern end of the Indian River Lagoon in Florida. Attenuation coefficients (k) were determined from light profiles taken at between 16 and 24 stations which were visited weekly. The submarine light profiles were obtained with a spherical quantum sensor (Li-Cor) between the hours of ten AM and two PM. At least five light measurements were taken in each profile and were corrected for fluctuating incident light due to cloud cover with a reference sensor located on the deck of the boat. The maximum depth of the profiles were two meters. All data were recorded and stored on a data logger which also served as the calibrated response meter for the sensor. Values of light attenuation (k) were calculated with a SAS computer algorithm. From the k values we estimated the amount of incident light transmitted through the water column to the maximum depths occupied by the seagrasses.

The area1 distribution of seagrasses was determined with 1/10,000 scale color aerial photography taken in April 1988 and May 1989 and ground verified throughout the study period. One hundred and thirty shore normal transects separated by 100m were surveyed at five meter intervals in the lagoon to determine the species composition and depth penetration of seagrasses.

The aerial photography was able to discriminate the distribution of Halodule wrishtii and Svrinsodium filiforme but not the genus Halonhila. Areas of the lagoon occupied by H. wrishtii and s. filiforme were easily distinguished but the signature for Halonhila appeared as unvegetated bottom. H. wriqhtii and S.filiforme grew to maximum depths of approximately 1.75 to 2.0 m (Figures 1 and 2). Average depth for H. wrishtii was 0.91 m and 1.1 m for s. filiforme. At depths exceeding 2.0 m Halophila decipiens, H. johnsonii and H. enselmanni grew. H. decipiens covered as much as 100% of the bottom in some of the deeper areas of the lagoon between April and October. H. johnsonii covered only about 3 to 5 % of the deeper area but was present all year long. H. enselmanni was only sparsely distributed in the most interior part of the lagoon.

There was a definite recurring seasonal cycle in the amount of light transmitted to 2.0 m; the lower depth limit of H. wriqhtii and s. filiforme (Figure 3). Maximum values of 40 to 50 % transmittance occurred in summer between May and August and 5 to 20 % between September and April. There were significant shorter term fluctuations within these larger time windows when either turbid or extremely clear water penetrated the lagoon. However, the majority of the values exceeded 10 to 15 % of the incident light (Figure 4). The lowest values, 5-7 % occurred after the passage of Hurricane Floyd in October of 1987 when attenuation coefficients were between 1.5 and 2.0. Following the storm it took 70 to 80 days for the lagoon to return to what appeared to be normal winter attenuation values. Tidal excursion from Jupiter Inlet is an important hydrographic parameter that influences the transparency of the water in the interior portion of Hobe Sound.

Neither water currents nor sediment characteristics could explain the sharp threshold of depth distribution for H. wrishtii and S. filiforme at 2.0 m. In the deeper waters of the lagoon vegetated by Halophila species and outside of the channel, maximum current velocities do not exceed 20 cm sec^{-1}. The near bottom shear velocities developed by these current speeds are well below values known to uproot seagrasses. In addition, the sediments are unconsolidated quartz sands with 10 to 15 % silt clay and are typical of sediments which support seagrass growth. Since these environmental parameters are well within the tolerable limits of seagrasses, we hypothesize that the lower depth distribution of H. wrightii and S. filiforme is due to light limitation. It appears as though the ecological light compensation point for these two species are in excess of 10 to 15 % of the incident light and are much greater than the previously reported values of 1 to 5 % for seagrasses and other aquatic plants. Criteria and standards for water quality which are based on lower values of compensation points probably cannot be used to protect seagrasses from deteriorating water transparency (turbidity).

FIGURE LEGENDS

FIGURE 1: Qualitative illustration of the depth distribution of seagrasses in Hobe Sound, Florida.

FIGURE 2: Frequency of occurrence of seagrasses H. wrishtii and S. filiforme as a function of water depth in Hobe Sound, Florida.

FIGURE 3: Percent of incident photosynthetically active radiation reaching a depth of 2m in Hobe Sound, Florida.

FIGURE 4: Frequency distribution of percent incident photosynthetically active radiation reaching 2m depth in Hobe Sound, Florida.

FIGURE 1

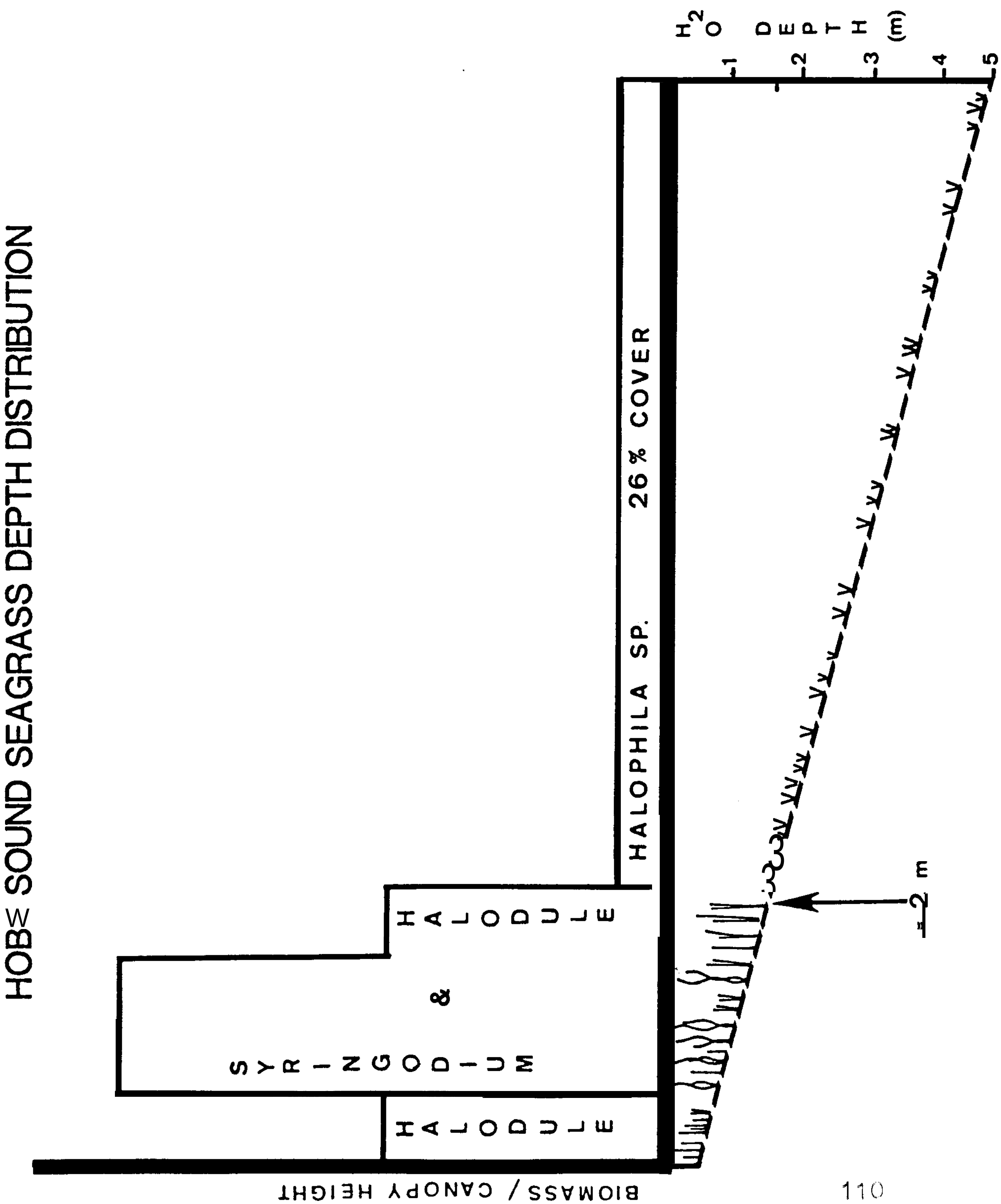

HOBE SOUND SEAGRASS DEPTH DISTRIBUTION
HALOPHILA SP. 26% COVER
HALODULE
SYRINGODIUM
&
HALODULE
H2O DEPTH (m)
1
2
3
4
5
2 m
BIOMASS / CANOPY HEIGHT

FIGURE 2

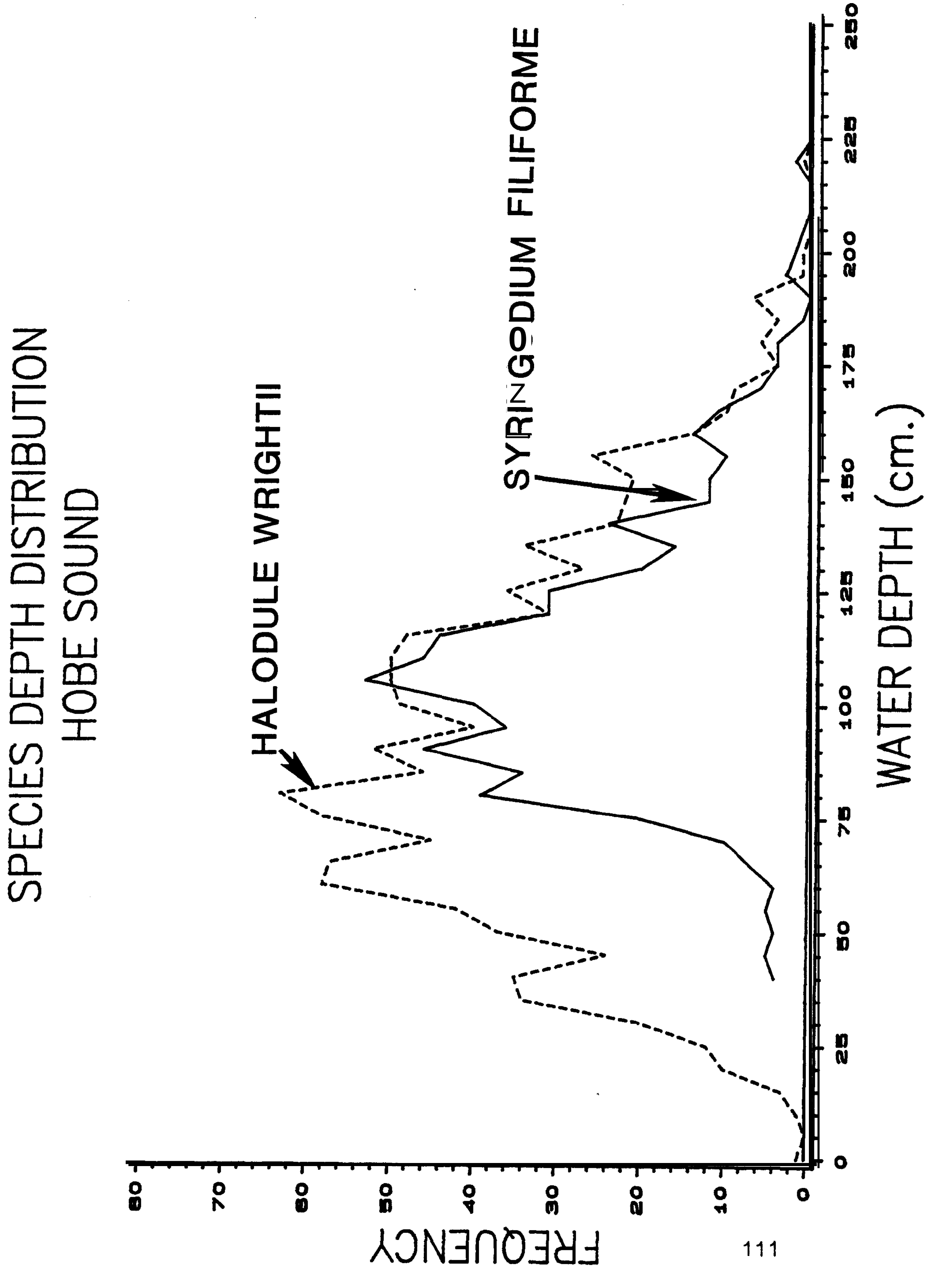

SPECIES DEPTH DISTRIBUTION
HOBE SOUND
HALODULE WRIGHTII
SYRINGODIUM FILIFORME
FREQUENCY
0
10
20
30
40
50
60
70
80
WATER DEPTH (cm.)
0
25
50
75
100
125
150
175
200
225
250

FIGURE 3

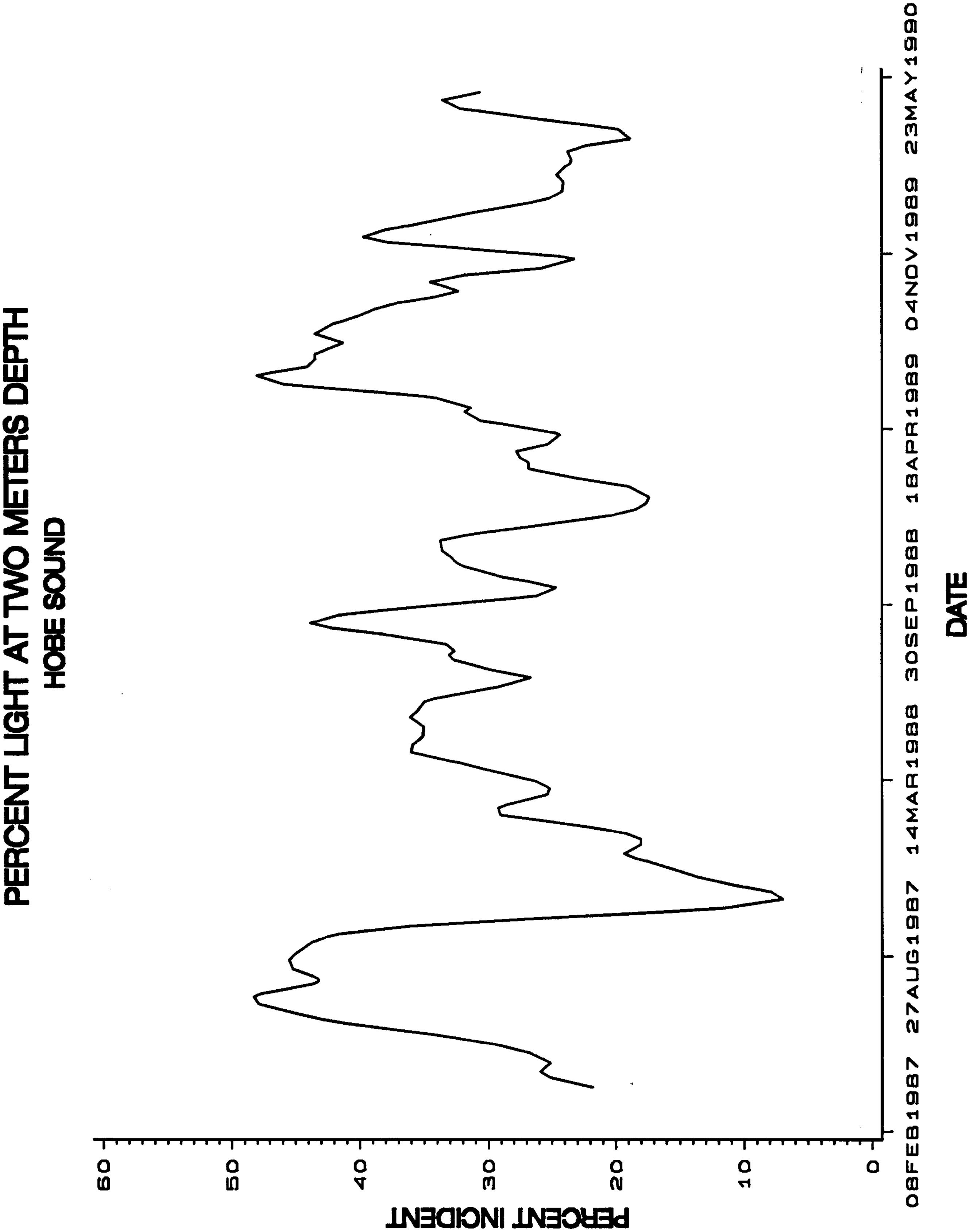
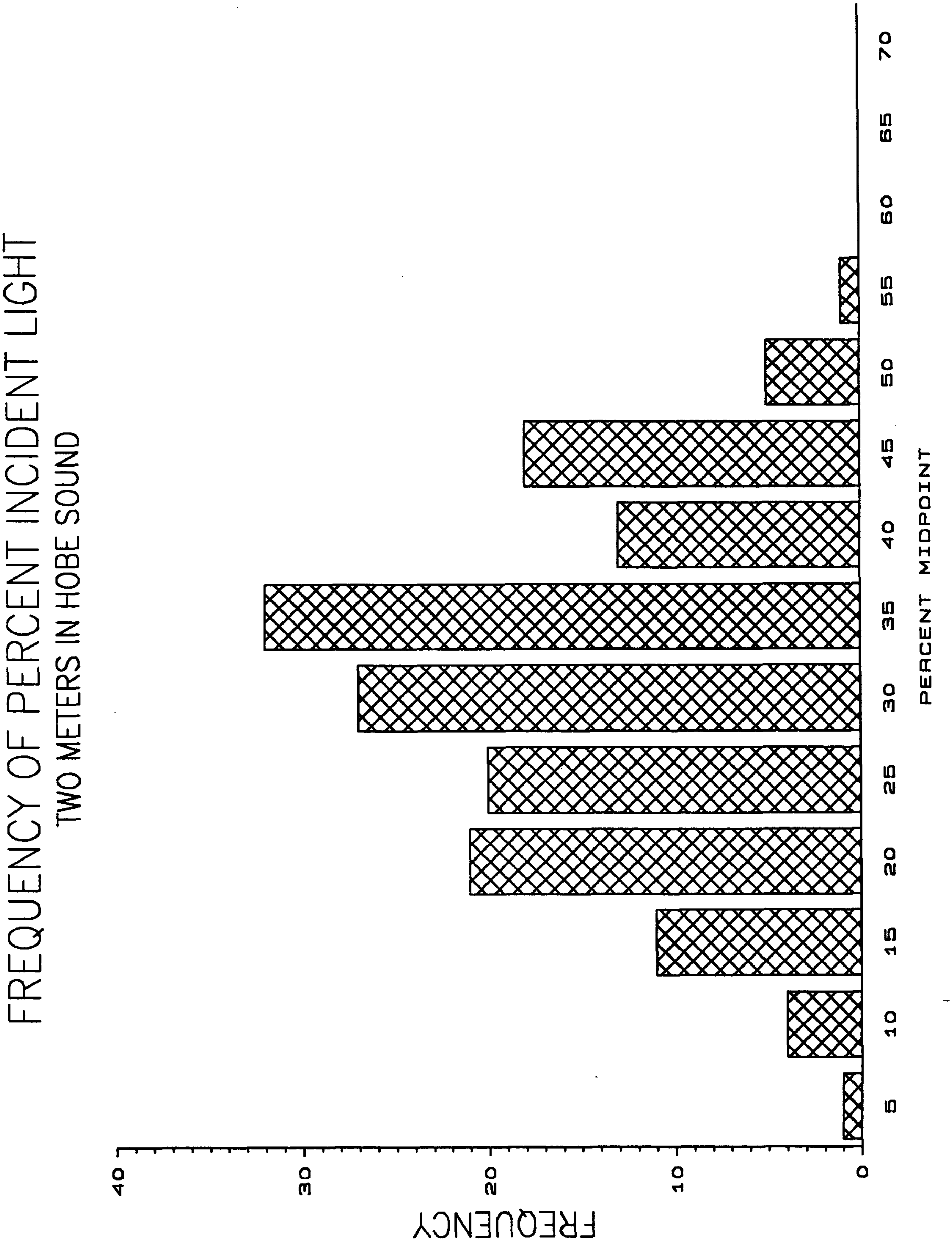

PERCENT LIGHT AT TWO METERS DEPTH
HOBE SOUND
PERCENT INCIDENT
0
10
20
30
40
50
60
DATE
08FEB1987
27AUG1987
14MAR1988
30SEP1988
18APR1989
04NOV1989
23MAY1990

FIGURE 4



FREQUENCY OF PERCENT INCIDENT LIGHT
TWO METERS IN HOBE SOUND
FREQUENCY
0
10
20
30
40
PERCENT MIDPOINT
5
10
15
20
25
30
35
40
45
50
55
60
65
70