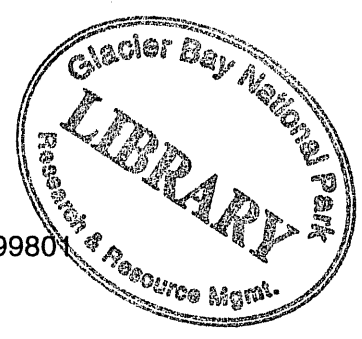


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Breeding landbird survey, East Arm, Glacier Bay (1997)

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Landbirds of Glacier Bay National Park have received little attention, compared to seabirds, with the exception of Trautman's (1966) early survey. In cooperation with the Park Service, we surveyed landbirds at selected sites along a vegetation gradient on the East Arm of Glacier Bay.

Methods.

Our East Arm censuses were conducted from 22-30 June, 1997; a supplementary census was done along the road to Bartlett Cove (in spruce-hemlock forest) on 19 June. We censused five 50m-radius plots per study site (fixed-radius point-count method), recording all birds seen and heard in each plot during 8 minutes (excluding flyovers). Plots were placed about 150m apart to avoid overlap in the point-counts. Censuses were conducted between 0500 and 0800h. We also kept notes on casual observations made outside of the formal censuses. Each site was censused only once, because of the limited time available. However, previous census work near Juneau has shown that at least four censuses distributed through the breeding season (approximately midMay til the end of June) are needed to document species diversity in forests in this region. Therefore our surveys in the park must be considered preliminary.

We sampled sites along a vegetation gradient, ranging from open ground with scattered shrubs through shrub thickets to tall trees in mixed forest on the East Arm. The vegetation gradient approximates a successional gradient but may combine several

sub-series. Vegetation was sampled in 20 plots of 5m radius along each census transect. We recorded the number and identity of all woody stems \geq 3cm DBH (Fig. 1).

We assessed 'structural diversity' of habitats visually and subjectively. The categories of structural diversity are as follows: Category 1 = sites with a few shrubs scattered across wide open spaces (Dryas mats, lichens, gravel); Category 2 represents sites of shrub thickets with small openings; Category 3 adds small trees to shrub thickets that were almost completely closed; Category 4 consists of sites with dense thickets overtopped by young cottonwoods; Category 5 is tall forest of mixed deciduous and coniferous trees, usually with a well-developed shrub layer. The Bartlett Cove site is tall spruce-hemlock forest. Thus, 'vegetation space' along the gradient first filled in horizontally and then added vertical layers.

We refrain from statistical analyses because the data are so preliminary. Instead, the results are presented graphically (summarized in Table 1, and shown in detail in Appendix 1). Likewise, we cannot make too much of sites with apparently unusual levels of abundance or diversity, because the census for any site depends on many factors, including weather, stage of nesting cycle of species that are present, and any number of unknown factors. Four-letter codes for bird species' names are in Appendix 2.

We travelled between study sites by kayak. This worked quite well, because study sites were relatively close together and were visited only once. There was plenty of time to move camp after a morning census. However, if repeat visits, for a more thorough census, were required, kayak travel alone would be too slow and weather-limited.

Results.

As expected, avian abundance was lowest in the first part of the vegetation gradient, where vegetation cover was least (Table 1; Fig. 2). An apparent peak of abundance was

recorded at Goose Cove. Another apparent peak of abundance was seen at Bartlett Cove; this may be because of the presence of forest-edge habitat along the road and the occurrence of some species (e.g., robins, juncos) that favor forest edges.

Species richness tended to increase along the vegetation gradient, again as expected, ranging from four to twelve species (14 at Bartlett Cove).

Bird abundance was unrelated to woody-stem density (Fig. 3), which was not unexpected, because high stem densities characterized habitats with little structural diversity (judged visually). For instance, sites with dense alder thickets and many young cottonwoods had very high stem density ~~be~~ were perhaps the most homogeneous in structural diversity.

In Fig. 4 we have attempted to cluster and rank the clusters of study sites by our subjective visual assessment of structural diversity of vegetation (in both horizontal and vertical dimensions). The trends in this figure mirror those in Fig. 2, but treat similar sites as 'replicates'.

We can see from Fig. 4 that avian species richness and abundance were high in Category 3, which offered structural diversity both horizontally (thickets and openings) and, to a lesser degree, vertically (addition of some trees). Species richness was again high in the tall forests, which offer vertical structure (layers of foliage, shrub to canopy).

Figures 5-10 show the distribution of particular species along the vegetation gradient. We call attention here to some of the salient or interesting patterns in these distributions (recognizing that some apparent trends may result simply from a one-time census).

Fig. 5: Hermit thrushes were most abundant in tall forest but occupied a wide range of vegetation structure (all except those with wide open spaces). Varied thrushes were most abundant in conifer forest but were also found in a fairly wide range of habitats. Gray-cheeked thrushes were most common in young cottonwood/alder stands and

occupied a smaller range of habitats than the other thrushes. Not surprisingly, robins were found chiefly in the habitats that offered lots of forest edge.

Fig. 6: All the warblers except Townsend's warbler were most abundant in the middle of the vegetation gradient. As expected, Townsend's warblers were found in areas with conifer trees. Orange-crowned warblers and Wilson's warblers occupied a wide range of habitats, in varying abundances.

Fig. 7: Fox sparrows were often very abundant and occupied a wide range of vegetation types. Savanna sparrows, as expected, were found in relatively open habitats.

Fig. 8: Both kinglets occurred where trees were present, but Ruby-crowns occupied a wider range than Golden-crowns. Our observations, here and elsewhere, suggest the ruby-crowns can be found wherever fairly tall conifers grow-- even a few conifers in a stand of deciduous trees suffices.

Fig. 9: Winter wrens occurred in conifer and mixed conifer/deciduous forests. Pacific-slope flycatchers occupied conifer and mixed forests but also were found in certain shrubby areas outside our formal censuses.

Fig. 10: Common redpolls were very common, especially in alder thickets, feeding on alder seeds. Pine siskins were less likely to be found in shrubby areas than redpolls, and more likely to occur where some trees were present.

Several additional landbird species were seen or heard outside of formal censuses: rufous hummingbird, pine grosbeak, willow ptarmigan, tree sparrows, chipping sparrow, barn swallow, bank swallow, merlin, snow bunting.

Discussion.

It is difficult to compare our surveys directly with those of Trautman(1966), because his transects were surveyed repeatedly, often crossed multiple vegetation types, and occurred almost entirely in areas we did not census.

A few observations stood out:

- 1) We found no Swainson's thrushes, although they occur near Juneau.
- 2) Pacific-slope flycatchers were heard singing in habitats that seem unusual for this species (deciduous thickets).
- 3) Fox sparrows reached the highest abundances recorded; redpolls were probably also nearly as common but often missed being censused because they were seen as flyovers.
- 4) Other relatively common birds (comprising >15% of the birds recorded at 3 sites or more) were orange-crowned warbler, yellow warbler, Wilson's warbler, and hermit thrush. All other species were less common or were common at fewer sites.

If we were to return to do more thorough censuses, we recommend the following:

- 1) Use of a motorboat to allow re-visits to study sites; kayaks can be used in conjunction with this, in order to reach motorless zones of the park, or for ferrying from camp to census site;
- 2) A longer census period, with censuses distributed over several weeks;
- 3) An extended vegetation gradient, including full conifer forest (without roads);
- 4) Measurements of structural diversity of vegetation;
- 5) Censuses along streams with newly-established salmon runs, for comparison with those along streams with ancient runs and those with no salmon runs, to determine the effect of the legacy of salmon nutrients on riparian bird communities (the Park is uniquely situated for this study);
- 6) Nest searching-- the apparently low abundance of jays and red squirrels in most parts of the park is likely to permit higher avian reproductive success than near Juneau. This information would be useful because a) mere density is often a poor indicator of the value of a habitat for particular species and b) it would allow us to test the hypothesis that nest predation is an important regulator of avian breeding success.

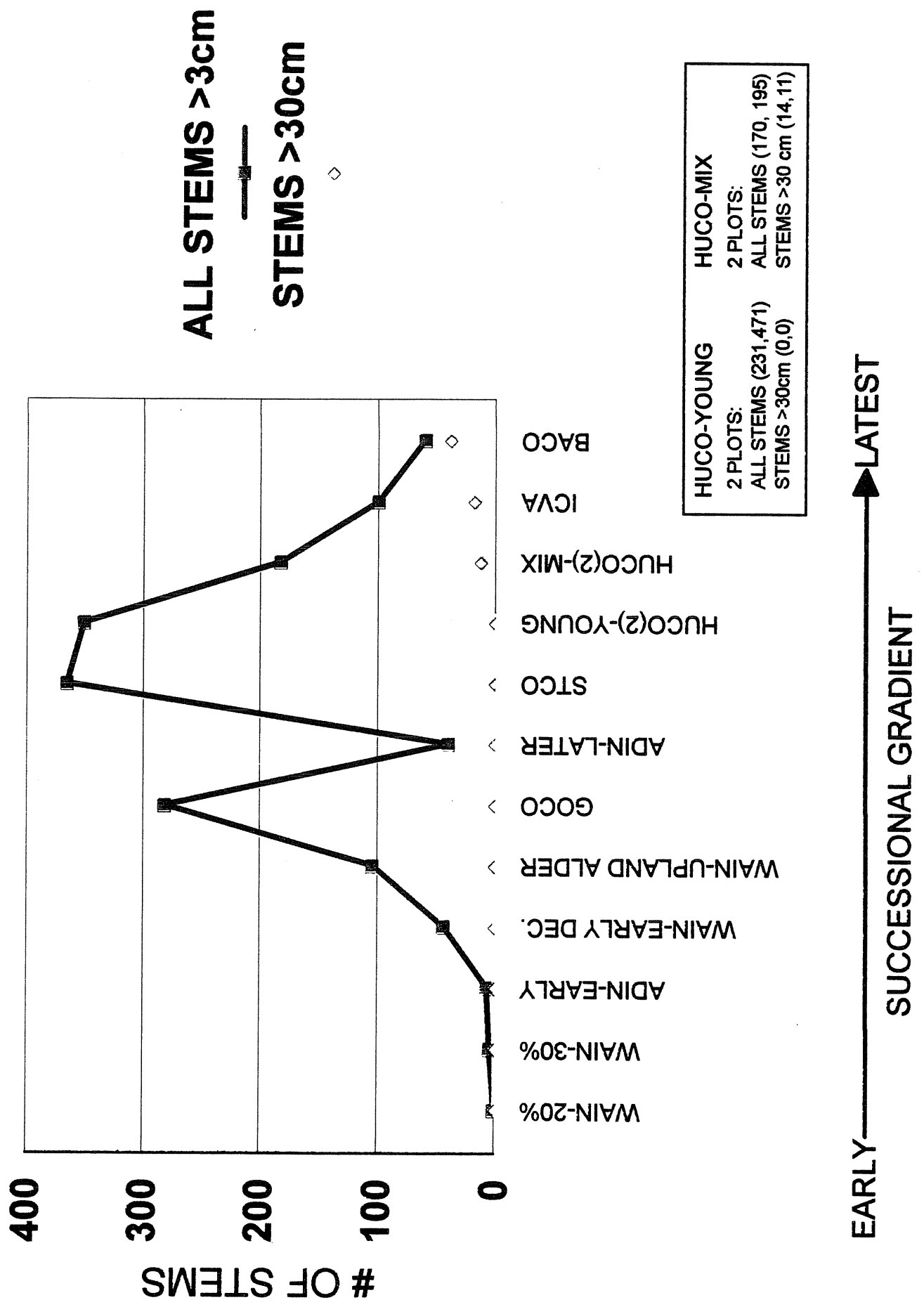
Acknowledgements.

We thank Ingrid HARRALD for able field assistance, Mary KRALOVEC for generous hospitality and logistical support, Chad SOISETH, Rusty YERXA, and Mary KRALOVEC for important background information.

Table 1.

SITE (ALPHA)	HABITAT	SPECIES RICHNESS	TOTAL # OF BIRDS	MEAN # PER POINT
Wachusett Inlet (WAIN-20%)	dry areas < 20% veg cover - scattered alder	4	22	4.4
Wachusett Inlet (WAIN-30%)	< 30% veg cover - alder, willow patches	7	22	4.4
Adams Inlet (ADIN-EARLY)	dry habitat with willow, alder and openings	10	28	5.6
Wachusett Inlet (WAIN-EARLY DEC.)	early deciduous with openings - alder, willow	5	17	3.4
Wachusett Inlet (WAIN-UPLAND ALDER)	upland alder thickets	7	31	6.2
Goose Cove (GOCO)	alder/willow scrub with cottonwood and openings	12	54	10.8
Adams Inlet (ADIN-LATER)	scattered willow/alder scrub with cottonwood, open areas and few spruce	12	37	7.4
Stump Cove (STCO)	alder-willow scrub thickets with cottonwood	9	42	8.4
Hunter Cove (HUCO-YOUNG)	young cottonwood	7	26	5.2
Hunter Cove (HUCO-YOUNG)	young cottonwood	8	33	6.6
Hunter Cove (HUCO-MIX)	mix spruce and tall cottonwood	12	35	7
Hunter Cove (HUCO-MIX)	mix spruce and tall cottonwood	11	30	6
Ice Valley (ICVA)	mix old spruce and tall cottonwood	12	35	7
Bartlett Cove (BACO)	mature spruce/hemlock	14	54	10.8

STEM COUNTS THROUGH SUCCESSIONAL STAGES

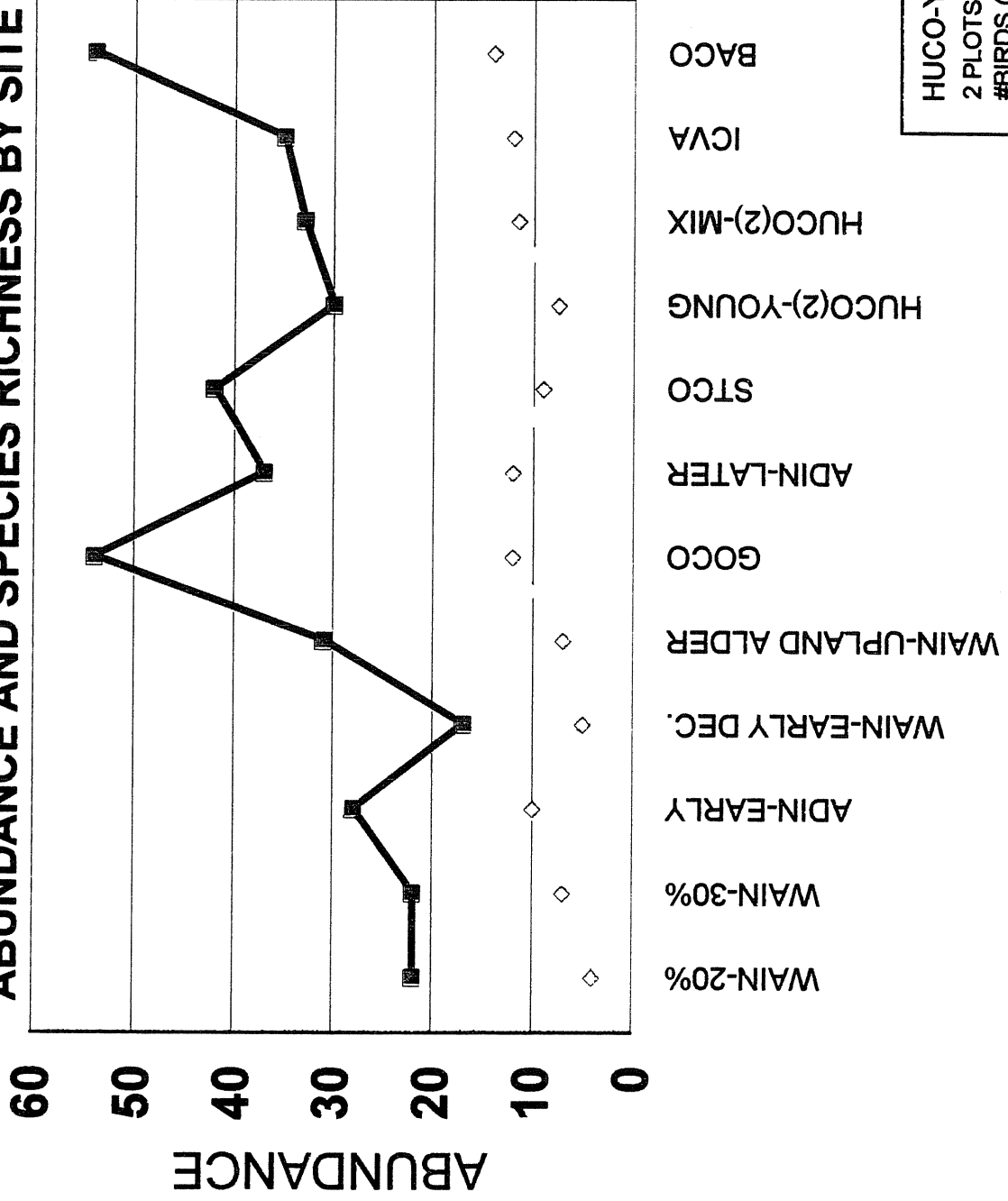


HUCO-YOUNG
 2 PLOTS:
 ALL STEMS (231,471)
 STEMS > 30cm (0,0)

HUCO-MIX
 2 PLOTS:
 ALL STEMS (170, 195)
 STEMS > 30 cm (14,11)

EARLY —————> LATEST
 SUCCESSIONAL GRADIENT

ABUNDANCE AND SPECIES RICHNESS BY SITE

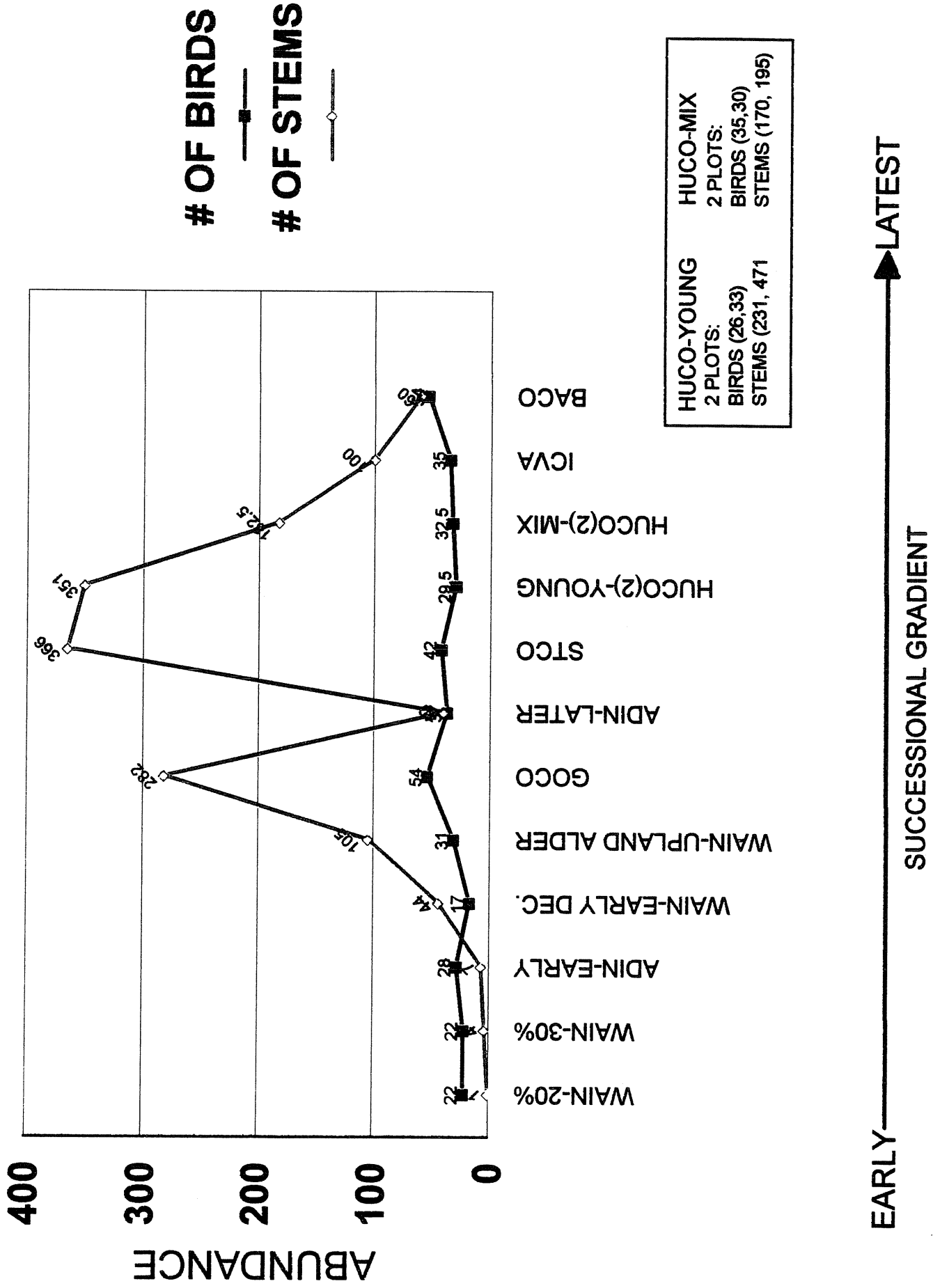


OF BIRDS
SPP. RICHNESS

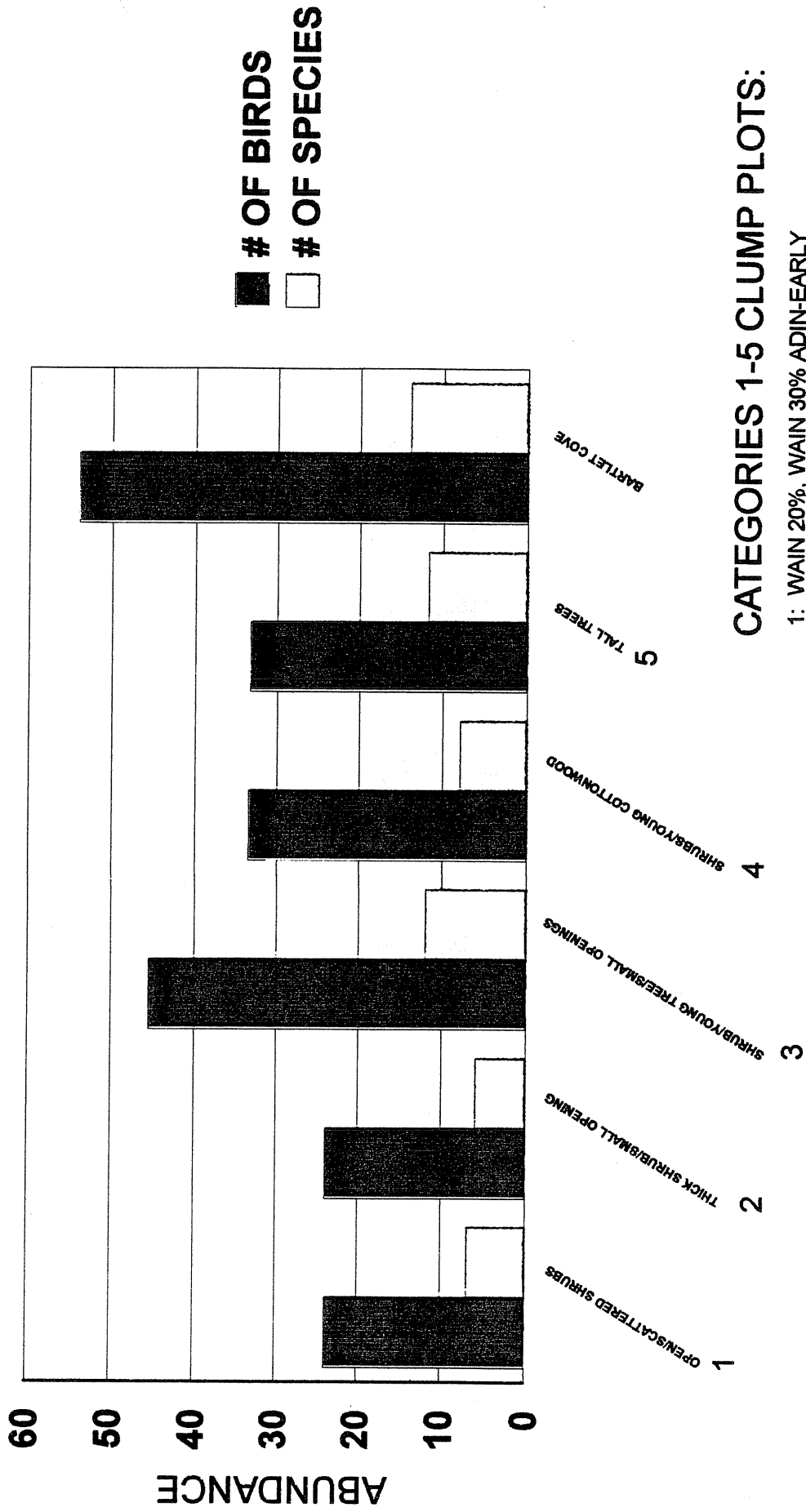
HUCO-YOUNG	HUCO-MIX
2 PLOTS:	2 PLOTS:
#BIRDS (26,33)	#BIRDS (35,30)
#SPECIES (7,8)	#SPECIES (12,11)

EARLY → LATEST

BIRD ABUNDANCE COMPARED TO # OF STEMS > 3 cm



ABUNDANCE AND SPECIES RICHNESS COMPARED TO VEGETATION SPACE*

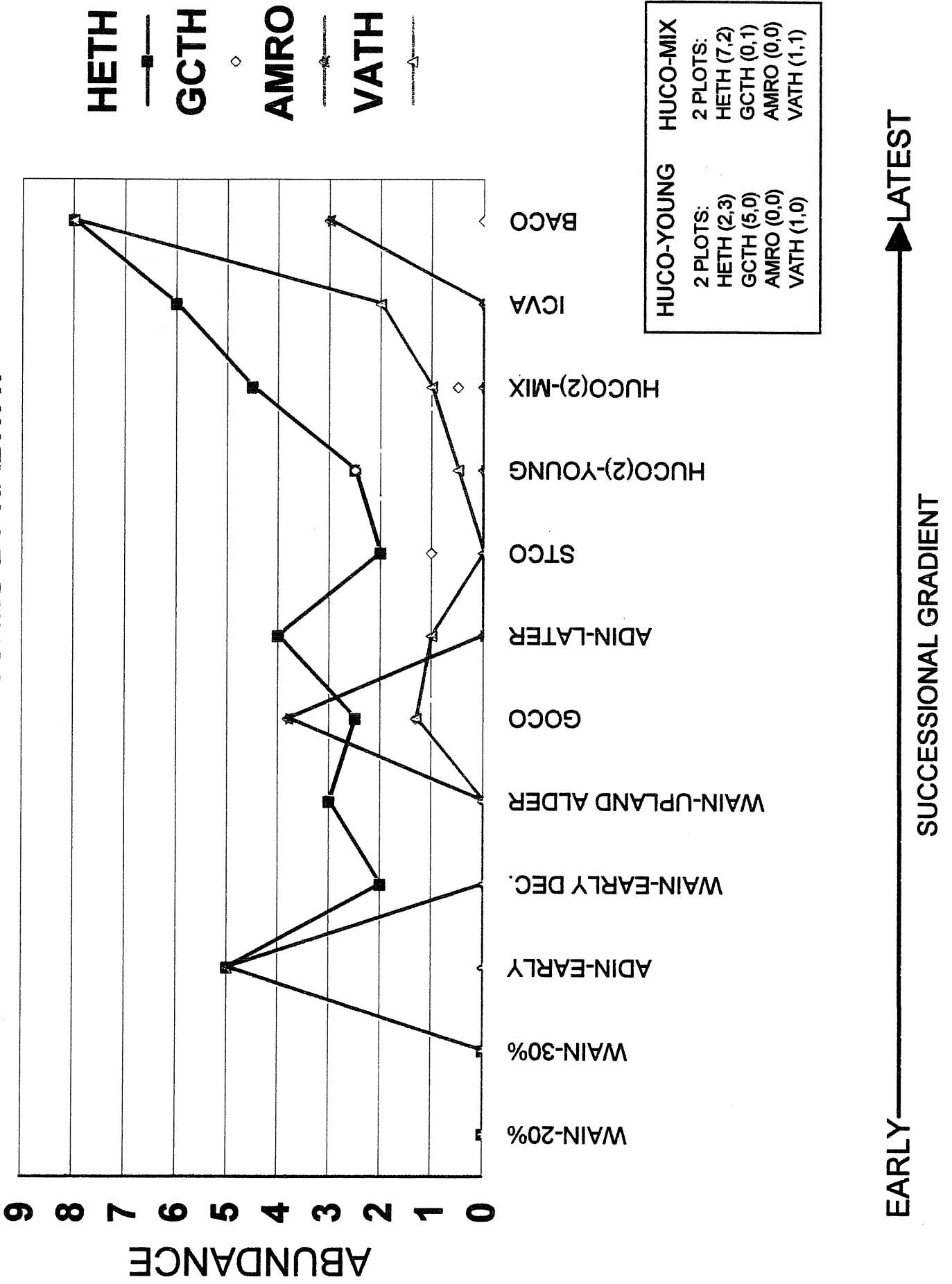


CATEGORIES 1-5 CLUMP PLOTS:

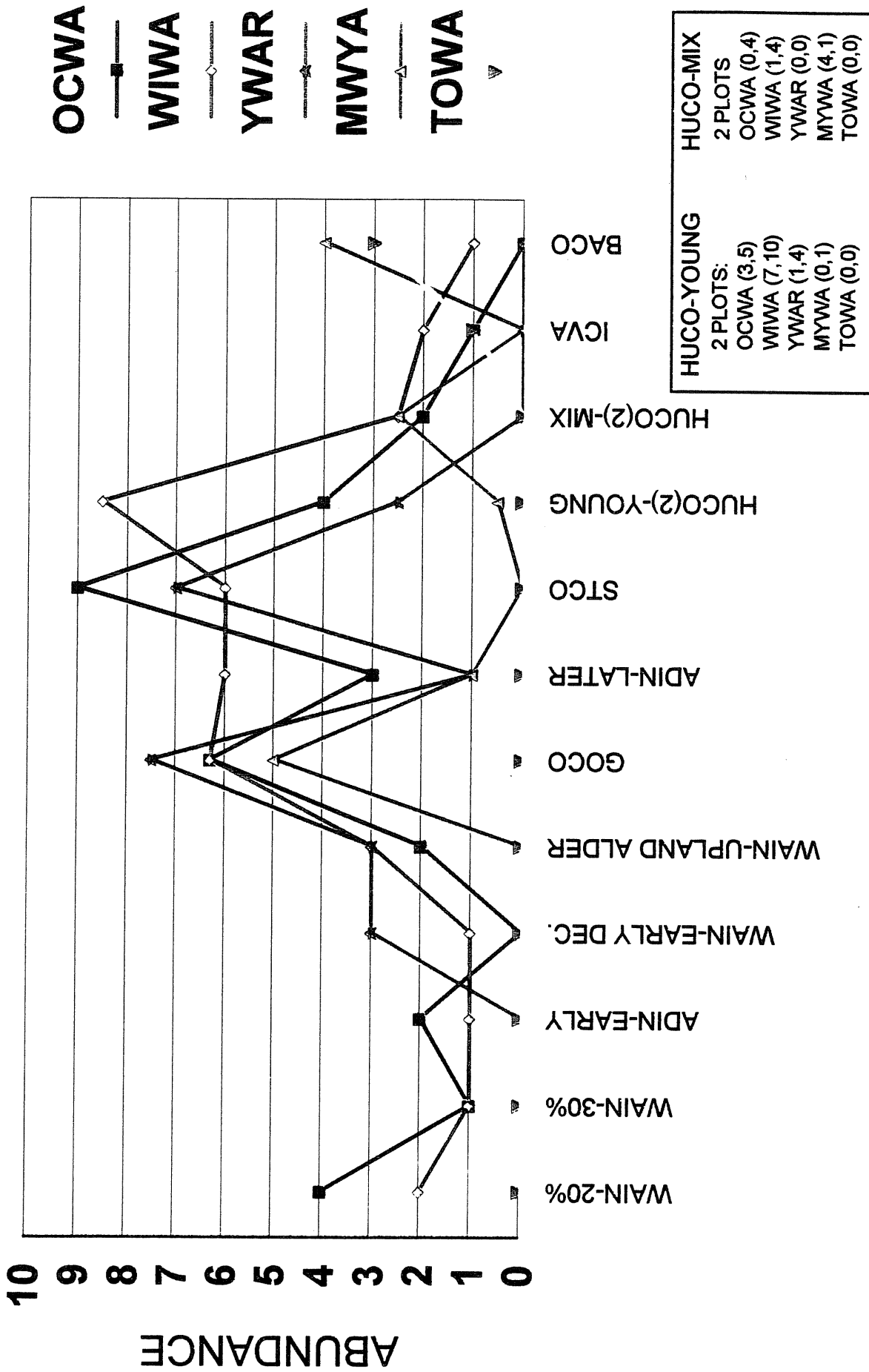
- 1: WAIN 20%, WAIN 30% ADIN-EARLY
- 2: WAIN-EARLY DEC., WAIN-UPLAND ALDER
- 3: GOCO, ADIN-LATER
- 4: STCO, HUCO-YOUNG (2 PLOTS)
- 5: HUCO-MIX (2 PLOTS), ICVA

* VEGETATION SPACE INCLUDES HORIZONTAL AND VERTICAL COMPLEXITY/VOLUME

ABUNDANCE OF THRUSHES BY HABITAT

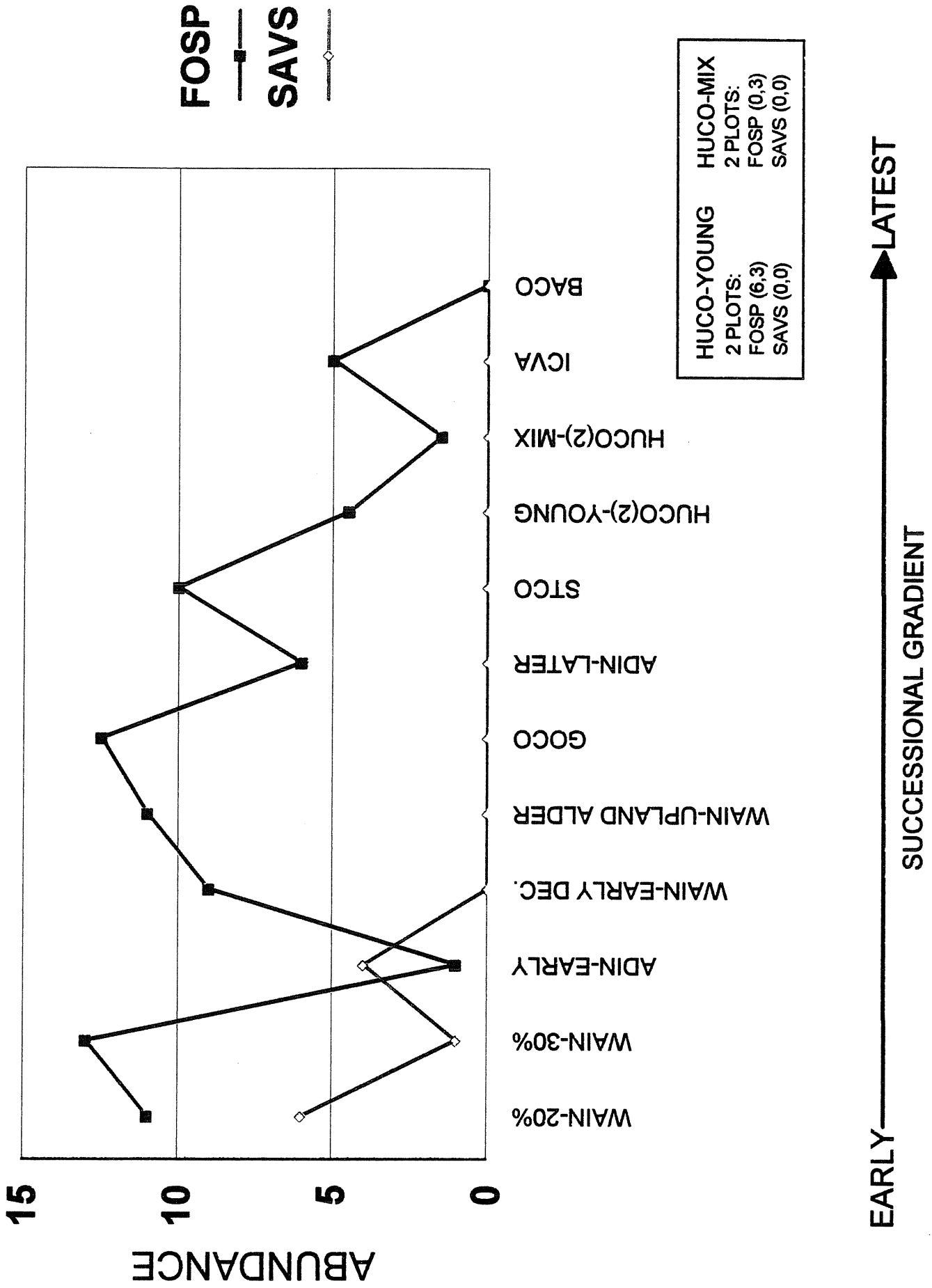


ABUNDANCE OF WARBLERS BY HABITAT

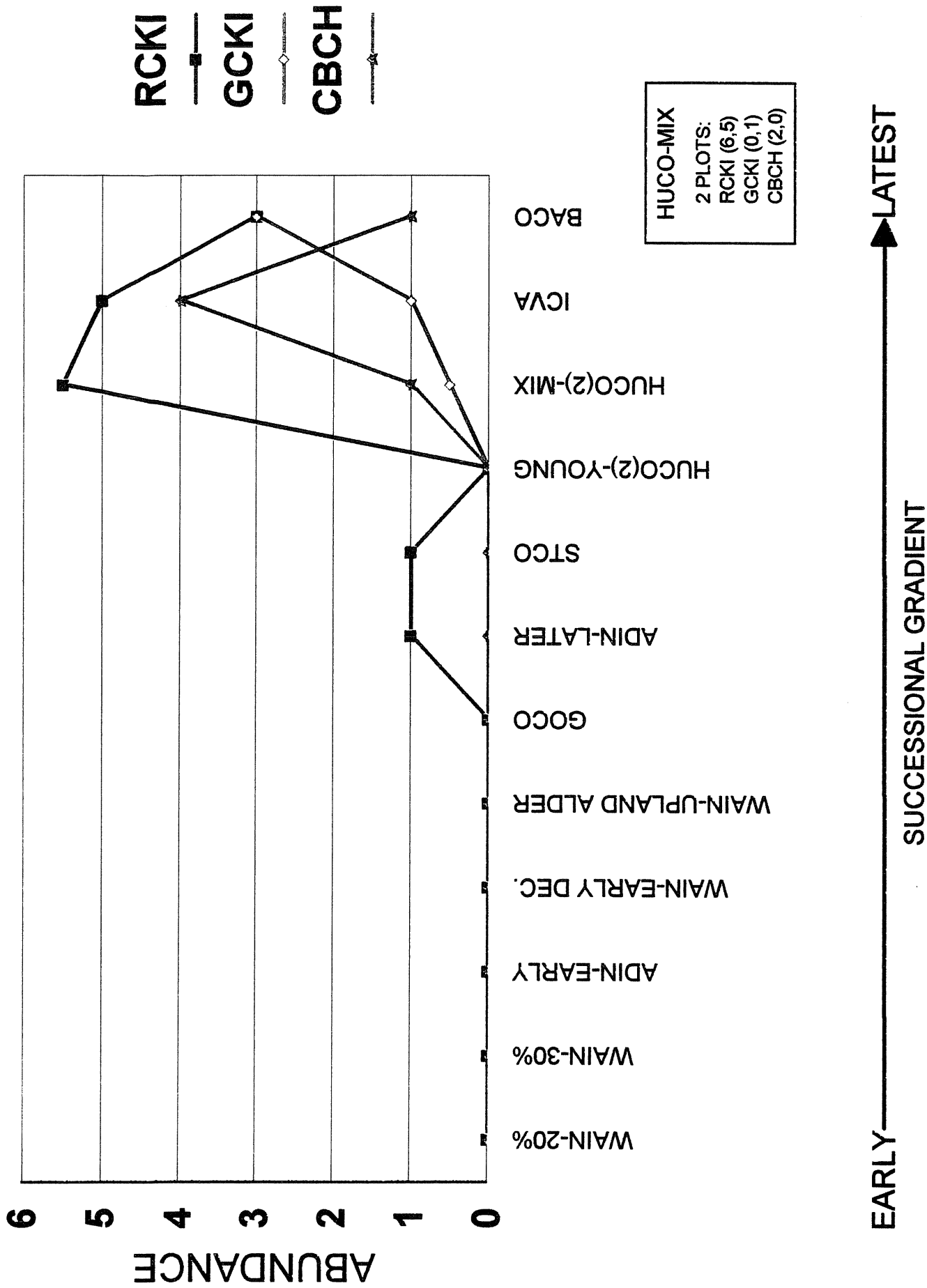


EARLY —————> LATEST
 SUCCESSIONAL GRADIENT

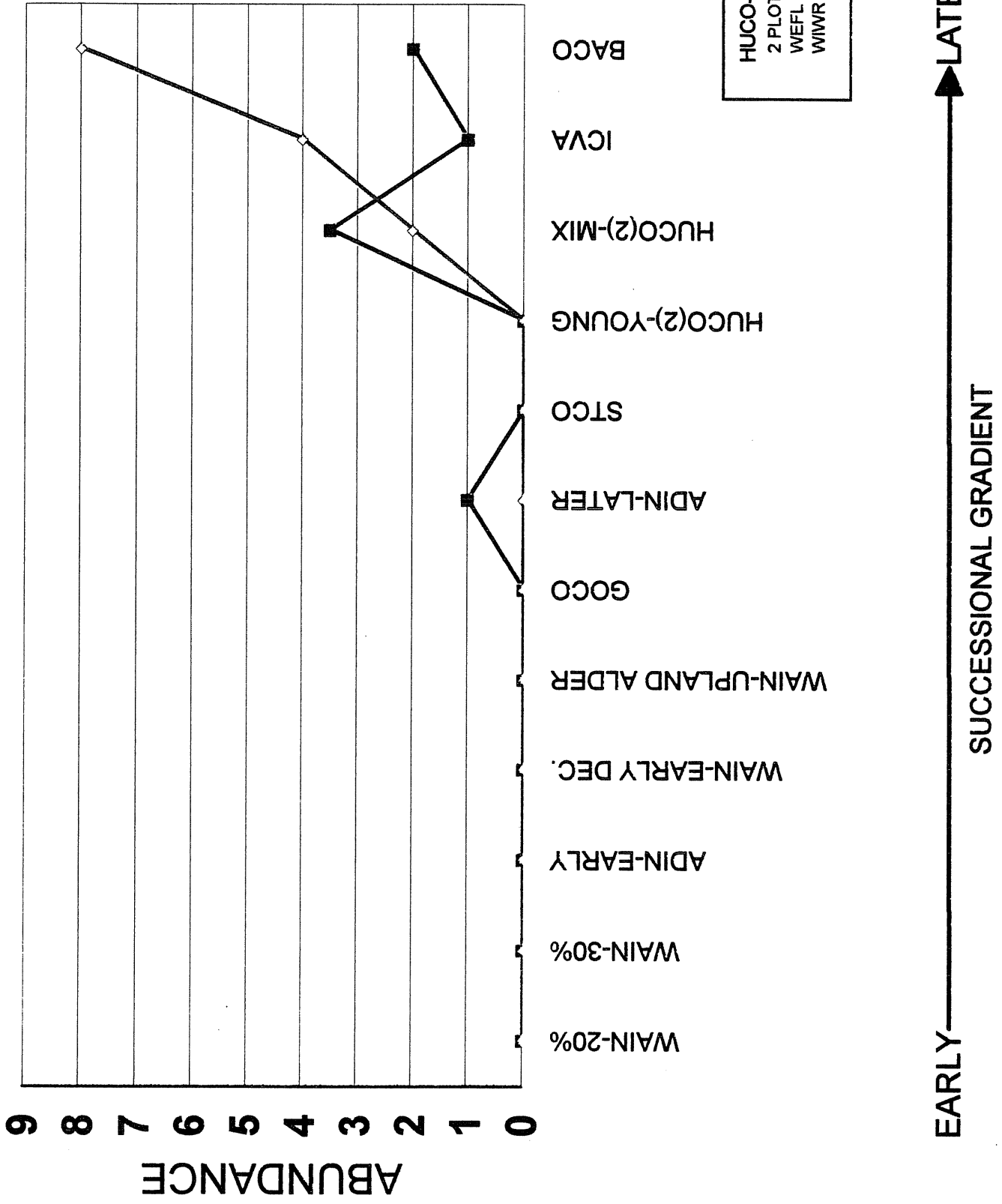
ABUNDANCE OF SPARROWS BY HABITAT



ABUNDANCE OF MISCELLANEOUS SPECIES BY HABITAT



ABUNDANCE OF MISCELLANEOUS SPECIES BY HABITAT



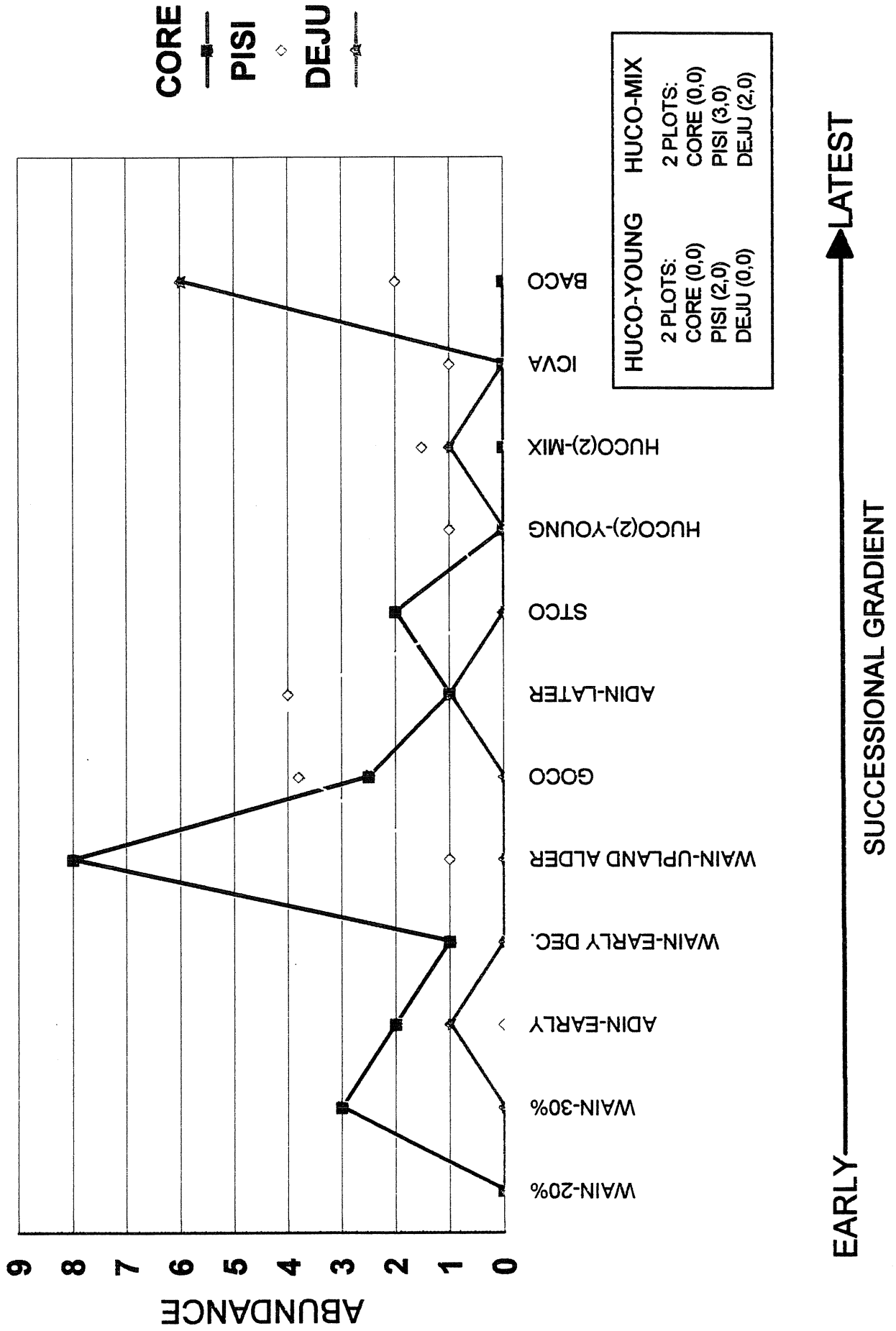
WEFL
—■—

WIWR
—◇—

HUCO-MIX
2 PLOTS:
WEFL (3,4)
WIWR (1,3)

EARLY → LATEST
SUCCESSIONAL GRADIENT

ABUNDANCE OF MISCELLANEOUS SPECIES BY HABITAT



Hunter Cove (HUCO-MIX)	mature spruce, cottonwood	25 June	heth	7	19.4%	12	35
			rcki	6	16.7%		
			mywa	4	11.1%		
			wefl	3	8.3%		
			pisi	3	8.3%		
			cbch	2	5.6%		
			nochr	2	5.6%		
			deju	2	5.6%		
			unk spar	1	2.8%		
			vath	1	2.8%		
			wiwa	1	2.8%		
			wiwr	1	2.8%		
Hunter Cove (HUCO-MIX)	mix - old spruce, cotton, alder	26 June	rcki	5	16.7%	11	30
			wiwa	4	13.3%		
			ocwa	4	13.3%		
			wefl	4	13.3%		
			fosp	3	10.0%		
			wiwr	3	10.0%		
			heth	2	6.7%		
			vath	1	3.3%		
			gcth	1	3.3%		
			mywa	1	3.3%		
			gcki	1	3.3%		

Goose Cove (GOCO)	scrub willow and alder with openings	20 June	fosp	12.5	23.3%	12	54
			ywar	7.5	14.0%		
			wiwa	6.3	11.6%		
			ocwa	6.3	11.6%		
			mywa	5	9.3%		
			amro	3.75	7.0%		
			pisi	3.75	7.0%		
			heth	2.5	4.7%		
			core	2.5	4.7%		
			vath	1.25	2.3%		
			gcth	1.25	2.3%		

Appendix 2.

4-letter alpha codes used for all bird species on tables and graphs

APHA CODE	Common Name
MYWA	Yellow-rumped (Myrtle) Warbler
YWAR	Yellow Warbler
OCWA	Orange-crowned Warbler
WIWA	Wilson's Warbler
TOWA	Townsend's Warbler
AMRO	American Robin
GCTH	Gray-cheeked Thrush
HETH	Hermit Thrush
VATH	Varied Thrush
FOSP	Fox Sparrow
SAVS	Savannah Sparrow
LISP	Lincoln's Sparrow
GCKI	Goldedn-crowned Kinglet
RCKI	Ruby-crowned Kinglet
CBCH	Chestnut-backed Chickadee
PISI	Pine Sisken
CORE	Common Redpoll
DEJU	Dark-eyed Junco
WIWR	Winter Wren
WEFL	Western Flycathcer (Pacific-slope flycatcher)
WAPI	Water (American) Pipit
CORA	Common Raven
NOCR	Northwestern Crow