

CONSONANT VOWEL BALANCE IN SERI (HOKAN) SYLLABLES

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1. PHONEME BALANCE IN SYLLABLES

The syllable for Seri¹ is a phonological unit consisting of a potentially stressed nucleus of from one to four vowels which may occur with margins of from one to four consonants. The various observed combinations of consonants and vowels constitute fifty canonical forms. In Table I these forms are arranged in four columns according to the number of vowels constituting the nucleus. Examples of these syllables which have been attested are listed below. The examples either occur in isolation or have borders which are distinguishable in discourse.²

EXAMPLES: (Where relevant, syllable division is indicated by low dot.)
1 *kWski.tóix* 'let's return for it', 2 *kWstép.kaʔa* 'it's going to be vegetation', 3 *kWsi.talʔáaʔáaʔi* 'he's going to sell it', 4 *kšXok* 'to hack', 5 *ptkamn* 'lobster', 6 *pti.kíai* 'pair', 7 *stak* 'pumice', 8 *ksipX* 'resin', 9 *Xo* 'but', 10 *kít* 'to be dull', 11 *kops* 'firefly', 12 *o.ták* 'toad', 13 *it* 'trunk', 14 *inš* 'spinal cord', 15 *Xkoktš* 'species of bush', 16 *kapšX* 'to be pitted', 17 *istx* 'leaf', 18 *ʔatX^wkW* 'penis', 19 *ʔyakWík* 'my ankle bones', 20 *kWskóoʔ.xox*

1 A language spoken in the State of Sonora in northwest Mexico and classified as Hokan. At present, Seri speakers number slightly over three hundred, the majority of whom usually reside in Desemboque, a fishing village located along the Gulf of California and to the north of Bahía Kino. At one time six bands, speaking three dialects, ranged the Sonoran coast from Puerto Lobos on the north to Guaymas on the south and occupied both Tiburon and San Esteban Islands. (See E. Moser, "Seri Bands", *The Kiva*, XXVIII, 1963, 14-27; Arizona Archaeological and Historical Society, Tucson.) Although the people are now more sedentary, many of them from time to time range along the coast from Puerto Lobos to Bahía Kino and on Tiburon Island. - The data presented in this paper were gathered in Desemboque during field trips made between 1952 and 1957. The analysis is based primarily on data obtained from Roberto Herrera T. The authors are indebted to Kenneth Pike, Viola Waterhouse and John Crawford of the Summer Institute of Linguistics for their help in the analysis and presentation of these materials.

² Due to the extensive clustering of consonants throughout the language, syllable division within words sometimes proves arbitrary. (See 7.0.)

1 CCCC	20 CCCC	37 CCCC	49 CCCC
2 CCCC	21 CCCC	38 CCCC	50 CCCC
3 CCCC	22 CCCC	39 CCCC	
4 CCCC	23 CCCC	40 CCCC	
5 CCCC	24 CCCC	41 CCCC	
6 CCCC	25 CCCC	42 CCCC	
7 CCCC	26 CCCC	43 CCCC	
8 CCCC	27 CCCC	44 CCCC	
9 CCCC	28 CCCC	45 CCCC	
10 CCCC	29 CCCC	46 CCCC	
11 CCCC	30 CCCC	47 CCCC	
12 CCCC	31 CCCC	48 CCCC	
13 CCCC	32 CCCC		
14 CCCC	33 CCCC		
15 CCCC	34 CCCC		
16 CCCC	35 CCCC		
17 CCCC	36 CCCC		
18 CCCC			
19 CCCC			

Table I. Canonical forms of the Seri syllable.

'let's shove off', 21 *kpkóo.yo* 'to taste (pl.)', 22 *kXnois*³ 'to be cluttered up', 23 *kfkookl* 'to cover (pl.)', 24 *Xkii* 'gourd', 25 *ktiip* 'to pinch with fingers', 26 *Xtoošp* 'species of plant', 27 *poo* 'wild boar', 28 *pait* 'blood', 29 *kiitk* 'to drip', 30 *ii* 'yes', 31 *ait* 'dance!', 32 *aasx* 'uta lizard', 33 *knoosxk* 'to be

³ All monosyllabic utterances cited in this paper have innate stress. In those with complex vowel nuclei, stress falls on the initial vowel.

rough (pl.)', 34 *kaafʒX* 'to go fast', 35 *aanpX* 'go home!', 36 *kookWsx* 'to shake off', 37 *kXkóaa.laj* 'to let fall (pl. repetitive)', 38 *kskóül.kaj* 'to lie down next to (pl. rep.)', 39 *kkaao* 'to place a curse', 40 *kkaaix* 'to spin', 41 *kkaailk* 'to spin (consecutive)', 42 *koai* 'to hunt lice', 43 *kaaom* 'to beg', 44 *áai.tox* 'fish (pl.)!', 45 *oaaf* 'loin string', 46 *kaaitx* 'grouper (fish, pl.)', 47 *eaalk* 'vertebrae', 48 ...*yaailXk* '...left them alone', *kiaai* 'to cost', 50 *eaai* 'sounds'.

Observable within these syllable limits is a feature of consonant-vowel balance. Assigning an arbitrary weight value of two units to each vowel and one unit to each consonant, it is noted that the maximum number of WEIGHT UNITS any syllable may represent is ten. Canonical forms 38, 41 and 48 each contain ten units. A theoretical maximal syllable of sixteen weight units, *CCCCVVVVCCCC*, might be anticipated; however, it does not occur. A heavy build-up of the pre-vocalic margin precludes a like build-up of the post-vocalic margin and vice-versa. Likewise, an expanding vowel nucleus is paralleled by a proportionately decreasing content of the combined consonant margins.

This balance may also be seen from two distribution curves. The first of these is based on a regrouping of the above canonical forms of the syllable according to the number of phonemes which each syllable contains. That is, syllables of one phoneme, forming the first group, are of only one pattern, V; syllables of two phonemes, forming the second group, are of three patterns, VV, CV, VC; etc. Eight groups result, forming the following curve: 1 3 6 10 12 10 8. The median falls within the group of 12, that group comprised of syllables consisting of five phonemes. The second curve is based on a regrouping of the canonical forms of the syllable according to the total number of weight units each syllable contains. Syllables of two weight units, forming the first group, are of only one pattern, V; syllables of three weight units, forming the second group, are of two patterns, CV, VC; etc. Nine syllable groups result, forming the following curve: 1 2 4 6 8 10 8 8 3. The median falls within the group of 10, that group comprised of syllables consisting of seven weight units.

As the complexity of the syllable margins and nuclei increases, a theoretically larger number of syllable patterns becomes possible. However, it will be seen from the curves that above a certain size, succeeding fewer patterns are actualized. Moreover, those syllables actualizing the more complex patterns occur less frequently than syllables actualizing the simpler patterns.

2. CONSONANTS

Seri has nineteen consonant phonemes:⁴ stops /p t k k^w ʔ⁵/; spirants, flat /f ɬ x X/, grooved/rounded /W s ʃ X^w/; nasals /m n ŋ/; oral sonants /l r y/. Stops and spirants are voiceless; nasals and sonants are voiced.

Stops /p t k k^w ʔ/ contrast at labial, dental, velar, and glottal points of articulation, with further contrast at velar position between /k/ and its labialized counterpart /k^w/. The off-glide is voiced before vowels and /y/, voiceless otherwise. *paix* 'willow', *takx* 'porpoise', *kap* 'desert hackberry', *k^wamíiti* 'ask him!', *ʔap* 'mule deer'. /k/ and /k^w/ have fronted variants contiguous to front vowels and preceding a contiguous front velar; they have back variants contiguous to /X/: *kiim* [k^híim] 'to sleep', *k^weept* [k^wéépt^h] 'quail', *kxip* [k^hxíp^h] 'to be flat', *kk^wimxk* [k^hk^wím^hxk^h] 'to deliver', *kXapš* [k^hXápš] 'to harden', *oXk^wáʔ* [oXk^wáʔ] 'stop it!'. When a morpheme beginning with /k/ in its normal form occurs following /W/, /k^w/, or /X^w/, its initial /k/ becomes /k^w/. /k/ has a front variant contiguous to /ɬ/: *Xpasíttiikl* [Xpásttiík^hl] 'ground squirrel'. Utterance final, /k/ is usually unreleased following a vowel, although it may vary freely to nasal release or slight aspiration: *stak* [sták^h] *sták^hy* *sták^hh* 'pumice'. Following a consonant, /k/ is usually slightly aspirated in utterance final position. It may vary freely to unreleased or nasal release and is occasionally glottalized: *kiʔiʃlk* [k^hiʔiʃlk^h] *k^hiʔiʃlk* *k^hiʔiʃlk^hy* *k^hiʔiʃlk^hʔ* 'to be dirty'. /p/ and /t/ have series of comparable phonetic variants, excepting the glottalized member, in utterance final position: *Xtoošp* [Xt^hóóšp^h] *Xt^hóóšp^hM* 'species of plant', *ʔákkaat* [ʔákkaat^h] *ʔákkaat* *ʔákkaat^hN* 'shark'. /t/ has an alveolar variant before /ʃ/: *tšiʔ* [tʃiʔ] 'swellfish'.

Flat spirants /f ɬ x X/ contrast at labial, alveolar, velar and back velar points of articulation respectively: *fáa fáa* 'so be it', *káafiʔa* 'it is a nose'; *káalan* 'to play (pl.)'; *xáaro* 'jar', *ʔáaxiʔa* 'it is a bird (a species of)'; *Xaapi* 'it's cold!', *yáaXiʔa* 'it is his stomach'. /ɬ/ is lateral; it has a voiced off-glide before a vowel: *kóanla* [k^hóan^hl^ha] 'tarantula'. /x/ is fronted contiguous to front vowels and following /t/: *Xáppiix* [Xáppii^hx] 'cane (reed)', *Pamtx* [Pám^ht^hx] 'tendon'. /X/ and /X^w/, the latter to be described below, feature marked trilling of the uvula.

⁴ Phonetic segments b, ɓ, w, occur also, but are restricted to use in nicknames which are often derived from Spanish: *aboxéena* 'dolphin' (from *bufeo*), *oša kissi* 'he who drinks grape juice' (from *uva*), *wéewo* 'egg' (from *huevo*).

⁵ /ʔ/ has been classified as a stop since its distribution is roughly parallel to that of the other members of the series. Note the following contrasts between glottal and "zero" onsets: *ʔait* 'blood!', *ait* 'dance!'; *ʔatXiin* 'head ring (for carrying basket)', *atXiin* 'make a head ring!'; *ʔiif* 'my nose', *iif* 'his nose'.

Grooved/rounded spirants /W s š X^w/ contrast at labial, alveolar, alveopalatal retroflex, and back velar points of articulation respectively: *káaWiPa* 'it is a bush (a species of)'; *saP* 'species of bird', *káasiPa* 'it is deflating'; *šaaP* 'sun', *káašipiPa* 'it is mesquite root'; *X^wássoot* 'it's narrow!', *imáXX^wiPa* 'it didn't defecate'. /W/ varies from lightly spirant to vocoid articulation.⁶ After /k/ in any position or preceding a vowel or /y/, the lip rounding is released rather than sustained: *kWšášni* [*kWšášni*] 'species of plant', *kapWéee* [*kapW^wéee*] 'to slander', *kóatWya* [*kóatWya*] 'is it sweet?'. Elsewhere a variant [O] occurs: *kaaW* [*káaoO*] 'species of bush', *PaWk^w* [*PáooK^w*] 'species of eel', *koatW* [*kóatO*] 'to be sweet'.

The phoneme sequence /kW/ contrasts phonetically with the phoneme /k^w/. In utterance final position the labialization of /k^w/ is barely released, if at all, and frequently is detected only by noting the lip position of the informant, e.g., *Pok^w* 'wood', *Pókk^wiPa* 'it is wood'. The phoneme /W/ after /k/, however, is clearly heard as an additional segment: *PayákW* 'ankle bone', *PayákWiPa* 'it is an ankle bone'. When the labialization of /k^w/ is released before a vowel, it is always voiced. /W/, however, is clearly voiceless, though before vowel it may also have a voiced off-glide. The two sounds may be shown phonetically before vowel as follows: [*káaoW^wiPa*] 'it is a bush (a species of)', [*iki k^wikáipx*] 'safety pin'.⁸

/s/ is fronted after /t/: *tsáammiix* [*tsáammiix̣*] 'was it warped?'. /š/ loses its retroflex quality when contiguous to /t/ or preceding /n/: *káštaš* [*kášt̪aš̪*] 'wheat', *kokášni* [*kokášni*] 'rattlesnake'.

/X^w/ has a slight voiced off-glide before vowels; before consonants or silence it is voiceless throughout. The labialization may be actualized as

⁶ The distribution of /W/ corresponds, in general, to that of both vowels and consonants: *kkiP^w* [*kkiP^wO*] 'to be red', *kiP^wo* 'to find', *kiP^wt* 'to hiccough'; *koWš* [*kóOš*] 'to be humped', *yooš* 'God', *kkafš* 'to snap at'. Interpretation of this segment as /W/ rather than as /O/ yields simpler, more consistent morphophonemics, in that morphemes following /W/ take the shape which follows consonants and not vowels.

⁷ Vowels except /o/, when they precede /W/, /X^w/, /k^w/, /k^w/, or /kX^w/, have a conditioned glide to [o].

⁸ On the basis of the examples [*Pok^w*] 'wood' and [*PayáokW*] 'ankle bone', /k^w/ has been set up as in contrast with /kW/. There is a fairly large number of words which for some speakers terminate in /kW/. For all such words except [*PayáokW*], this varies freely toward /k^w/. There is thus no convincing evidence of contrast apart from this one example. Morphophonemic evidence bears out the uniqueness of *PayáokW*. All other words ending in isolation in either /k^w/ or /kW/, when followed by a vowel in combined forms, have /k^w/, not /kW/: *kiamk^w* 'men', *ktámk^wiPa* 'they are men'; *kšooXk^w* 'to be four', *kšooXk^wiPa* 'there are four'. After phonemes other than /k/, /W/ retains its voicelessness when followed by vowel: *kiapW* 'to be ground up fine', *kiápWiPa* 'it is ground up fine'.

simultaneous lip rounding rather than off-glide: *PišaPóoX^wiPa* 'it is my upper arm', *PaX^wl [PáoXl]* 'cherry stone clam'.

Nasals /m n ŋ/ contrast at labial, dental, and velar points of articulation respectively: *smámkaPa* 'it is going to be cooked', *siiskankaPa* 'it is going to be hard', *siiskañkaPa* 'they are going to arrive'. /n/ is backed to alveolar position before /š/, and before /t/ when /t/ precedes /š/: *eentš [éentš]* 'knives'. With certain informants /m/ varies freely with /ŋ/ in utterance final position. In the transition from a stressed vowel to a contiguous /n/, the tongue tip effects a sharp cut-off of the vowel producing a glide resembling English /d/.

Oral sonants are /l r y/. /l/ is lateral: *laXiiktin* '(a mountain name)', *kóalaala* 'to flap'. /r/ is a flap and occurs only in Spanish loans: *rook^w* 'crazy'. /y/ is palatal: *yášlil* 'slime'.

3. VOWELS

Seri has four vowel phonemes /i e o a/ which contrast as to high and low and as to front and back: *kip* 'to dig up', *šel* 'parrot', *kops* 'firefly', *kap* 'desert hackberry'.

/i/ is a high close front vowel which tends to vary freely with [i^v] in unstressed single vowel position. In a multiple sequence of this phoneme the final /i/ is backed to [i̠] when preceding /X/: *kiiX [k̠iiX]* 'to flow'.

/e/ is a mid open front vowel which has a phonetic quality varying between [e] and [æ].

/o/ is a mid close back vowel and is the only rounded vowel. A variant [o̠] occurs as the nucleus of a stressed syllable when followed by /n/ or /š/: *PéPee kkón [PéPee kkó̠n]* 'onion', *Póšala [Pó̠šala]* 'sic 'em!'. This variant also occurs in a complex nucleus following stressed /i/: *kioks [k̠io̠ks]* 'to be prickly'.

/a/ is a low open central vowel: *stak* 'pumice'.

4. NASALIZATION

Nasalization is a suprasegmental phoneme which occurs with the total constituency of a vowel nucleus and is symbolized by /_d/. While it may occur with any vowel (symbolized by V), nasalization is restricted to vowel nuclei preceded by /k^w/.⁹ The following examples contrast nasal and oral

⁹ The only exceptions noted to the above restriction are: *i̠* 'yes', *PiP̠iki* '(a nickname)'.

vowels: *k^wʃkke* 'person', *k^wipóošXaŋ* 'divisions'; *k^wεXl* 'don't take it!', *k^weep* 'quail'; *k^wóttiix* 'it is dry', *kótte* 'to cure'; *k^wqakiiʔ* 'to be new', *k^wamliit* 'ask him!'. In the idiolects of certain speakers, the phoneme sequences /k^wV-/ and /kmV-/ contrast in certain words: *k^wakkáii* 'to be young', *kmatóttiisxox* 'to prevaricate (pl.)'. For other speakers these sequences occur as free variants: *k^wqam/kmaam* 'female'. Still other speakers appear to use either /k^wV-/ or /kmV-/ exclusively.¹⁰

5. STRESS

Stress, symbolized by /'/, is phonemic and serves to differentiate certain pairs: *ʔipXaš* 'my nephew (w.s.)', *ʔipXáš* 'our flesh'. Stress occurs on each of the four vowel phonemes and normally falls on the first member of a vowel sequence. In certain constructions the first word loses its stress and usually a feature of consonant or vowel length as well. Thus, *náapXa* 'buzzard' plus *kkim* 'to throw at' becomes *napXa kkím* 'to have poor luck begging food'. Further analysis of stress, especially in relation to intonation, remains to be made.

6. INTONATION

A partial analysis of the intonation patterns shows four basic pitch levels which range from 1, low, to 4, high. In general, utterances begin on level 2 or 3 and terminate on level 1. Tentative pause occurs on level 2. Statements having a single stress are usually characterized by a gradually rising pitch contour which reaches level 3 on either the stressed or pre-stress syllable from which it drops to level 1 on succeeding syllables: *ʔe² ka²tík³pa¹ni¹ʔa¹/ʔe² ka³tík¹pa¹ni¹ʔa¹* 'I am working'. Sometimes the pattern varies to a gradual pitch decrease from level 3 to level 1: *ʔe² ka²tík³pa²ni²ʔa¹* 'I am working'. Two interrogative sentence types occur, each of which is characterized by its own distinctive intonation contour. The first type, which elicits a yes or no response, features a gradually rising contour which reaches level 4 on the syllable preceding the final stress of the utterance and then drops to level 1 on the stressed syllable: *me² mos² sa²tík³pan⁴-*

¹⁰ Other idiolectal differences have been noted. These may well be a carry-over from former dialect and band divisions. For instance, several speakers use a labiodental spirant instead of a bilabial for /f/. In certain words some speakers make one or more of the following phoneme substitutions: s > š, t > l, X > x, m > n, ŋ > m, i > a.

kée¹ya¹ 'are you also going to work?'. This contour is manifested by a 4-1 downglide on a monosyllabic form: *tiim⁴⁻¹* 'was he sleeping?'. The second interrogative type elicits an explanatory response and features an intonation contour which begins at level 3 and falls gradually to level 1, with pitch changes usually occurring on stressed syllables: *ʃi³moxk^Wsa³tlk²pan²kée¹ya¹* 'when is he going to work?'. Another contour which occurs with the second interrogative type and with imperative forms denotes alarm or astonishment and consists of a relatively constant pitch on level 4: *ʔóok⁴ta⁴* 'look!'. Still another contour type which occurs is a monotone which holds on either level 2 or 3 through most of the utterance, with the pitch contour decreasing to level 1 at final pause. This type, which is accompanied by gruff vocal quality, denotes a reproving or berating attitude.

Emphasis is expressed by extreme lengthening of a stressed vowel nucleus and/or of a consonant contiguous to that nucleus.

Seri phonological structure is characterized by stress-timed rhythm. The general acoustic impression is of a rhythmic, almost chant-like cadence. In discourse, groups of unstressed syllables are uttered rapidly on level 2 with a sharp transition to level 3 on the stressed syllable. A stressed vowel nucleus of more than one mora of length usually carries a falling glide to level 2. Within a descending pre-pause contour, a stress peak is often on the same or even a lower pitch level than the preceding syllable.

7.0. CONSONANT DISTRIBUTION CLASSES

The matrix chosen for the presentation of phoneme distribution is the syllable. Consonants occur singly and in sequences of from two to four in onsets and codas. Multiple-consonant interludes are comprised of from two to six consonants (but not more than four within the word) and are seemingly myriad. Three hundred of these interludes have been tabulated for testing purposes. Some examples are: *kámlaxk* 'to bring (pl.)', *káoksXax* 'to be long', *ʔakéekt ktám* 'father-in-law (m.s.)', *ʔant kXtóopk* 'to sleep here (pl.)', *ʔáasklX smašim ʔáaʔi* 'if it becomes mottled, it won't be pretty'. Of these three hundred interludes, only several have proven indivisible into permitted onsets and codas, e.g. *ʔayákWlxox* 'ankle bones'. Furthermore, syllable divisions made within these interludes are often arbitrary. Thus the following description of consonant sequences is restricted to those occurring as onsets and codas in utterance initial and final positions.

Four emic distribution classes have been set up.¹¹ In describing the classes, a consonant is symbolized by C. The vowel nucleus, which may consist of from one to four vowels, is symbolized by V. The hyphen preceding or following V indicates one or more optionally occurring consonants which are irrelevant to the consonant slot being described. A superscript numeral indicates the emic class: C¹V-. A superscript letter indicates the alloclass or variant of the emic class: C^{1a}V-.

Consonant Class 1. Class 1 consonants fill the slot immediately preceding or following the vowel nucleus. Membership: /p t k k^w ʔ f l x X W s š X^w m n ŋ l r y/.

All consonants occur in this class.

Membership variants (Alloclasses):

1a: /p t k k^w ʔ f l x X - s š X^w m n - l r y/ (a hyphen indicates a hiatus in this etic class, i.e. the corresponding phoneme listed above does not occur here) distributed in the C^{1a} slot of C^{1a}V-: *peen* 'yoke', *tom* 'money', *keelX* 'paddle', *k^weept* 'quail', *ʔast* 'stone, mountain', *feel* 'species of duck', *ʔiʔiʔi*¹² '(a nickname)', *xaponées*¹³ 'Japanese', *Xáššoox* 'mountain lion', *séetteen* 'sea pen', *šamt* 'blue crab', *X^wássoot* 'it is narrow', *móxxeet* 'bighorn sheep', *náapXa* 'buzzard (red head)', *laXiikitiŋ* '(a mountain name)', *rook^w* 'crazy', *yeéšx* 'scales of fish'.

1b: /p t k k^w ʔ f l x X W s š X^w m n - l r y/ distributed in the C^{1b} slot of -VC^{1b}V-: *Xapóo* 'sea lion', *ʔatáap* 'pus', *kokášni* 'rattlesnake', *iki k^wikáipx* 'safety pin', *kiʔiíššaata* 'to become shady', *kifáʔš* 'to sob', *káaliŋ* 'to play', *paxáas* 'squid', *kiXéelle* 'to become humid', *káaWiʔa* 'it is a bush (a species of)', *kasámmiikt* 'to be jealous', *košápliŋ* 'to sew', *ikkii X^wássoot* 'it narrows to a point', *kameéppiit* 'to marvel', *konée* 'desert grass', *Xpaléemmealx* 'species of sea-shell', *aristóon* 'ribbon', *koyókkó* 'dove'.

1c: /p t k k^w ʔ f l x X W s š X^w m n ŋ l r y/ in the C^{1c} slot of -VC^{1c}: *šep* 'eagle', *ʔaat* 'species of bush', *oták* 'toad', *Pok^w* 'wood', *šaaʔ* 'sun', *ʔaaf* 'nose', *tal* 'ember', *ʔáppaax* 'octopus', *ʔaX* 'water', *ikóokkaW* 'balsa cargo spike', *kis* 'to be raw', *ʔakáiš* 'spear', *kooX^w* 'to defecate', *šiXkám* 'fish', *ʔaan* 'species of clam', *ʔakóoštiŋ* 'lover', *likál*¹⁴ '(a nickname)', *kaar* 'sheep', *kaay* 'horse'.

1d: /p t k k^w ʔ f l x X - s š - m n - - r y/ in the C^{1d} slot of CC^{1d}V-: *ʔpéettiix* 'was it circular?'. (Members of this alloclass and succeeding

¹¹ These consonant classes are patterned after Pike's illustration of emic classes of English phonemes in *Language in Relation to a Unified Theory of the Structure of Human Behavior*, II, 25-30.

¹² /t/ occurs in this consonant slot only in nicknames.

¹³ /x/ occurs in this consonant slot only in loans.

¹⁴ /l/ occurs in this consonant slot only in nicknames.

alloclasses of each distribution class occur within two-consonant sequences. For a complete list of examples of those members, see 7.1.).

1e: /- t k - ʔ - ɬ - X - s ʃ - m n - - - - / in the C^{1e} slot of CCC^{1e} V-: *tXtamt* ‘was it a lot?’.

1f: /p t k k^w - - - - - m - - - - - / in the C^{1f} slot of CCCC^{1f} V-: *kWspátxkkaʔa* ‘it is going to spread out’.

1g: /p t k - ʔ f ɬ x X W s ʃ X^w m n ŋ - r - / in the C^{1g} slot of -VC^{1g} C: *kXopt* ‘to become extinguished’.

1h: /p t k - ʔ f ɬ - X W s ʃ X^w m n ŋ - - - / in the C^{1h} slot of -VC^{1h} CC: *kaptx* ‘to be wide’.

1i: /p t k - ʔ - - - - - m - - - - - / in the C¹ⁱ slot of -VC¹ⁱ CCC: *ʔpotiipWkW¹⁵* ‘squeeze me!’.

Consonant Class 2. Class 2 consonants fill the second slot preceding or following V. Membership: /p t k k^w ʔ f ɬ x X W s ʃ X^w m n/. This class excludes the voiced consonants except /m/ and /n/.

Membership variants:

2a: /p t k k^w ʔ - ɬ x X - s ʃ - m - / in the C^{2a} slot of C^{2a} CV-: *ptaakt* ‘species of bush’.

2b: /p t k - - f - x X W s ʃ - - - / in the C^{2b} slot of CC^{2b} CV-: *kpkóoyo* ‘to taste (pl.)’.

2c: /- t - - - - - s - - - - - / in the C^{2c} slot of CCC^{2c} CV: *kWtmeet* ‘did he believe it?’.

2d: /p t k k^w - - ɬ x X W s ʃ X^w - n / in the C^{2d} slot of -VCC^{2d}: *kitp* ‘to spit’.

2e: /p t k - - - ɬ x X W s ʃ X^w - - / in the C^{2e} slot of -VCC^{2e} C: ...*ʔtifpk* ‘...my arrival’.

2f: /- - - - - X^w - - / in the C^{2f} slot of -VCC^{2f} CC: *ʔatX^wkW* ‘penis’.

Consonant Class 3. Class 3 consonants fill the third slot preceding or following V. Membership: /p t k ʔ ɬ x X W s ʃ /. This class excludes the voiced consonants and /k^w/ and /f/.

Membership variants:

3a: /p t k ʔ - - X - s - / in the C^{3a} slot of C^{3a} CCV-: *ptkamn* ‘lobster’.

3b: /- - - - - W - - / in the C^{3b} slot of CC^{3b} CCV-: *kWsmóonxkkaʔa* ‘it is going to be zigzagged’.

3c: /- t k - ɬ x X W s ʃ / in the C^{3c} slot of -VCCC^{3c}: *ʔakWt* ‘houses’.

3d: /- - k - ɬ - X W s - / in the C^{3d} slot of -VCCC^{3d} C: *ʔpotiipWkW* ‘squeeze me!’.

¹⁵ Initial consonant sequences beginning with /ʔ/ may optionally be preceded by /i/.

Consonant Class 4. Class 4 consonants fill the fourth slot preceding or following V. Membership: /kʔ x W/.

Membership variants:

4a: /k ʔ -- / in the C^{4a} slot of C^{4a}CCCV-: *kWspátxkkaʔa* 'it is going to spread'.

4b: /k - x W/ in the C^{4b} slot of -VCCCC^{4b}: *ʔyakWlk* 'my ankle bones'

7.1. To describe two-consonant sequences, sub-alloclasses of alloclasses 1d and 2d have been set up. The sub-alloclass is indicated by a numeral following the alloclass.

Sub-alloclasses of alloclass 1d:

1d1: /- t ----- X s -- n -- / in the formula C^{2a}/p/C^{1d1}V-, in which /p/ is the filler of the C^{2a} slot: *pteept* 'species of plant', *pXáWk^wi* 'eight', *psaak* 'hunger', *pnaokl* 'species of nut'.

1d2: /p t k - ʔ f - x X s š m n r - / in the formula C^{2a}/t/C^{1d2}V-: *tpokt* 'was it full?', *ttóknix* 'was it round?', *tkam* 'was he full?', *tʔanl táššoo kkw^wtiʔ* 'eleven', *tfit* 'did he arise?', *txiišši* 'did it hurt?', *tXapš* 'was it hardened?', *tsáammiix* 'was it crooked?', *tšikáktox* 'cardinal (bird)', *tmiišx* 'was it clean?', *tnooʔk^wW* 'was it concave?', *trook^w* 'was he crazy?'.

1d3: /p t k k^w ʔ f - x X s š m n -- / in the formula C^{2a}/k/C^{1d3}V-: *kpokt* 'to be full', *ktooml* 'rooster fish', *kkáppiʔa* 'it is flying', *kk^wáassoot* 'to loan', *kʔeel* 'to be red', *kfit* 'to arise', *kxiišši* 'to pain', *kXapš* 'to harden', *ksai* 'hairbrush', *kšimpXa* 'to become moldy', *kmássool* 'to be yellow', *knofix* 'to be jagged'.

1d4: /----- ʔ ----- y/ in the formula C^{2a}/k^w/C^{1d4}V-: *k^wʔapXáši* 'cover it with it!', *k^wyaʔtáXka* 'it was striped'.

1d5: /p t k -- f -- X s š m n - y/ in the formula C^{2a}/ʔ/C^{1d5}V-: *ʔpošáX^wt* 'you (pl.) tell it to me!', *ʔtapšX* 'signal him!', *ʔkaii* 'grow up!', *ʔfit* 'stand up!', *ʔXomni* 'I didn't feel it', *ʔsáaktim ʔáaʔi* 'I'm going to cut it', *ʔšim* 'chuckle!', *ʔmeXl* 'I took it', *ʔniʔš* 'kick him!', *ʔyaʔlittaax* 'I burned it'.

1d6: /----- X ----- / in the formula C^{2a}/l/C^{1d6}V-: *lXéekkoox* '(a camp name)'.

1d7: /-- k ----- / in the formula C^{2a}/x/C^{1d7}V-: *xkoa* 'species of bush'.

1d8: /p t k k^w -- l ----- n -- / in the formula C^{2a}/X/C^{1d8}V-: *Xpasittükl* 'ground squirrel', *Xtoošp* 'species of plant', *Xkoksš* 'species of bush', *Xk^wéenne* 'species of gourd', *Xlóllo* 'mullet fingerlings', *Xnaamóttat* '(an extinct dialect group)'.

1d9: /p t k - ʔ f l x X s - m n r - / in the formula C^{2a}/s/C^{1d9}V-: *spiitkin*

'species of clam', *stak* 'pumice', *skóššiiŋkaʔa* 'it is going to get hot', *sʔámookkaʔa* 'it is going to get dark', *sfiʔ Páaya* 'do you want him to stand?', *slóotX^wla* 'evil spirit', *sxiššiiikaʔa* 'it is going to hurt', *sXápškaʔa* 'it is going to harden', *ssliippiitkaʔa* 'he is going to mature', *smášxiixkaʔa* 'it (a stone) is going to explode', *snáaffiixkaʔa* 'it is going to be spiralled', *sróokk^waʔa* 'he is going to go crazy'.

1d10: /--k-----š----/ in the formula $C^{2a}/\check{s}/C^{1d10}V-$: *škaXtstip* 'boy', *ššimpXakaʔa* 'it is going to become moldy'.

1d11: /----ʔ-----/ in the formula $C^{2a}/m/C^{1d11}V-$: *mʔitóix...* 'our return...'.
 Sub-alloclasses of alloclass 2d:

2d1: /-t k -l x X W s š X^w -/ in the formula $-VC^{1g}/p/C^{2d1}$: *kXopt* 'to become extinguished', *kXtoopk* 'to remain overnight (pl.)', *ʔapʔ* 'tongue', *ʔayanópx* 'fist', *ksipX* 'resin', *ktapW* 'to be ground up fine', *kops* 'firefly', *kXapš* 'to harden', *moxípX^w* 'crissal thrasher'.

2d2: /p - k k^w l x X W s š - -/ in the formula $-VC^{1g}/t/C^{2d2}$: *kitp* 'to spit', *kiitk* 'to drip', *tatk^w* 'species of fish', *katl* 'to be wild (pl.)', *kastimmeetx* 'to make bread (pl.)', *šatX* 'cactus fruit thorn', *kitW* 'species of sea bass', *ʔáppaats* 'Apache', *kméessootš* 'to be unused (pl.)'.

2d3: /p t - - l x - W s š X^w -/ in the formula $-VC^{1g}/k/C^{2d3}$: *kkaakp* 'to pound', *kpokt* 'to be full', *Xpasítiiikl* 'ground squirrel', *saakx* 'species of clam', *ʔayákW* 'ankle bone', *ʔaoks* 'arms', *šakš* 'cockle shell', *ksikX^w* 'to rock baby on cradle board'.

2d4: /-t - - - x - W s š - -/ in the formula $-VC^{1g}/ʔ/C^{2d4}$: *kokéʔt* 'to bounce', *kamiʔx* 'to plane', *kkiʔW* 'to be red', *kiʔs* 'firstborn child', *kifáʔš* 'to sob'.

2d5: /p t k - l - - - - š - -/ in the formula $-VC^{1g}/f/C^{2d5}$: *koafp* 'to bounce off', *koaft* 'whirlwind', *kaafk* 'to pound a hard object', *an ikifl* '(a camp name)', *kkafš* 'to snap at'.

2d6: /p - k - - - X - - - - -/ in the formula $-VC^{1g}/l/C^{2d6}$: *kiʔp* 'to sniff', *kóottaalk* 'ants', *kiiʔʔoolX* 'to belch',

2d7: /p - k k^w - - - - - - - -/ in the formula $-VC^{1g}/x/C^{2d7}$: *kkoxp* 'to leap forward', *íttaaxk* 'bones', *šimoxk^w* 'when (interrog.)'.

2d8: /p t k - l - - - - - š - -/ in the formula $-VC^{1g}/X/C^{2d8}$: *kooXp* 'to be white', *kiXt* 'to be small (pl.)', *kiXk* 'to melt (pl.)', *ʔeXI* 'take it!', *ʔaXš* 'dog'.

2d9: /- - - - - - - - - š - -/ in the formula $-VC^{1g}/W/C^{2d9}$: *koWš* 'to be humped'.

2d10: /- t k - l x X W - - X^w -/ in the formula $-VC^{1g}/s/C^{2d10}$: *Past* 'stone, mountain', *knoosk* 'to be rough', *kmasl* 'to be yellow (pl.)', *Xaasx*

'sagueso', *koosX* 'to count', *keesW* 'to be barefoot', *k^wPesX^w* 'hide it!'.
 2d11: /p t k - ɪ x X - - - - -/ in the formula -VC^{1g}/š/C^{2d11}: *Xtoošp*

'species of plant', *košt* 'cricket', *PaXáašk* 'arrows', *kk^wapXášl* 'to cover (as with an apron)', *šoošx* 'burlap bag', *kkašX* 'to tear'.
 2d12: /- t - - - ɪ - - - - -/ in the formula -VC^{1g}/X^w/C^{2d12}: *ṖposaX^wt*

'you (pl.) tell it to me!', *PaX^wl* 'cherry stone clam'.
 2d13: /- t k k^w ɪ x X W s š X^w n/ in the formula -VC^{1g}/m/C^{2d13}: *Pašáamt*

'adobe', *Pakóomk* 'younger sisters (m.s.)', *ktamk^w* 'men', *siml* 'barrel cactus', *katáamx* 'to notch arrow', *kamX* 'say it!', *eamW* 'lightning', *iṖíms* 'fringe', *ikiṖímsš* 'ringworm', *PaamX^w* 'maguey', *k^woptóomn* 'to be weakened'.
 2d14: /- t k - ɪ x - - - - - š X^w -/ in the formula -VC^{1g}/n/C^{2d14}: *Pant*

'year', *Ṗonk* 'sea gull', *kṖanl* 'to be ten', *yaanx* 'poison sap', *inš* 'spinal cord', *anX^w* 'much'.
 2d15: /- - k - - - - - - - - -/ in the formula -VC^{1g}/ŋ/C^{2d15}: ...*kóostɪŋk*

'...the singer.'.
 2d16: /- - k - - - - - - - - -/ in the formula -VC^{1g}/r/C^{2d16}: *toerk* 'willet'.

Voiced open transition occurs between members of the sequences /Ṗt mk mn nk nx/ when these sequences occur immediately following a stressed vowel: *kiṖt* [*kɪṖ^oɪ^h*] 'to hiccough'. With some speakers, close transition occurs in all other types of consonant sequences. With still other speakers, voiceless open transition occurs in sequences consisting of stop plus stop (except /Ṗ/ plus other stop) and stop plus nasal. Close transition occurs in geminate clusters.

Geminate clusters are found to be in phonemic contrast with single consonants in utterance initial and medial positions and are structurally analogous to clusters of diverse consonants.

7.2. Three-consonant sequences occurring syllable initially are described by stating each filler of the C³ slot in the formula C³C²C¹V- and the fillers of the C²C¹ slots with which it combines.

With /p/ as the filler of C³, the following occurs as filler of C²C¹: /tk/ e.g. *Ṗtkamn* 'lobster'.

With /t/ as the filler of C³, the following occur as fillers of C²C¹: /Xt, Xn/ *tXtamt* 'was it a lot?', *tXnois* 'was it cluttered up?'.

With /k/ as the filler of C³, the following occur as fillers of C²C¹: /pk fk Wt WX Ws Wš xk Xt Xn sk šk šX/ *kṖkóoyo* 'to taste (pl.)', *kṖkookl* 'to put on wraps (pl.)', *kWtóottix* 'was it dried up?', *kWXonyáXXi* 'they are not all there', *kWset* 'species of bush', *kWšášni* 'species of plant', *kxkoil* 'to let fall (pl.)', *kXtoopk* 'to remain overnight (pl.)', *kXnois* 'to be

cluttered up', *kskóoyo* 'to smell (pl.)', *kškoomt* 'to chuckle (pl.)', *kšXok* 'to hack'.

With /ʔ/ as the filler of C³, the following occur as fillers of C²C¹: /pk ps pm sk sk^w ss sm šX šš/ *ʔpktim*... 'my sleeping...', *ʔpsütaaX* 'I'm going to go', *ʔpmiifp* 'I arrived', *ʔskommáktimaʔa* 'I'm not going to touch it', *ʔsk^wáqʔa* 'I'm not going to understand', *ʔssáktimaʔa* 'I'm going to use it', *ʔsmóššiaʔa* 'I'm going to dream', *ʔšXok* 'hack it off!', *ʔššéXXee ʔáaʔi* 'I'm going to slit it open'.

With /X/ as the filler of C³, the following occurs as filler of C²C¹: /pk/ *Xpkiml* '(a nickname)'.

With /s/ as the filler of C³, the following occur as fillers of C²C¹: /kt Xt Xk Xn/ *sktámmootkéeya* 'is it going to be a boy?', *sXtámkaʔa* 'it is going to be a lot', *sXkóktškaʔa* 'it is going to get old (slang)', *sXnóiskaʔa* 'it is going to be cluttered up'.

Three-consonant sequences occurring syllable finally are described by stating each filler of the C¹ slot in the formula -VC¹C²C³, plus the fillers of the C²C³ slots with which it combines.

With /p/ as the filler of C¹, the following occur as fillers of C²C³: /tk tx tX tX^w kW lk xk Xt Xl st šx šX X^wt X^wl/ ...*k^wqkéepk* '...they who got sick.', *kaptx* 'to be wide', *imáptX* 'forehead scar', *kaptX^w* 'to be punctured', *PamápkW* 'gun powder', *yanóplk* 'its hooves', *ʔapápxk* 'beads', *yáapXt* 'its forearm', *kkapXl* 'to be sour', *keepsł* 'sand crab', *sleenápšx* 'heron', *kapšX* 'to be pitted', *kopX^wt* 'to be loose', *šiiptX^wl* 'palo verde'.

With /t/ as the filler of C¹, the following occur as fillers of C²C³: /kš lk xk Xl X^wl sx/ *ʔitkš* 'my younger sister (w.s.)', *kXatlk* 'to be thin (pl.)', *ʔatxk* 'white tern', *kitXl* 'to be shattered', *ʔayatóotX^wl* 'kidney', *kmatsx* 'to prevaricate'.

With /k/ as the filler of C¹, the following occur as fillers of C²C³: /tš tx lk Wt sx sX šx/ *yektš* 'Yaquis', *kak^wéssaaktx* 'to light fire (pl.)', *taklk* 'porpoises', *ʔakWt* 'houses', *kiksx* 'to be unripe', *kaksX* 'to awaken', *ʔaokšx* 'sea catfish'.

With /ʔ/ as the filler of C¹, the following occur as fillers of C²C³: /tx kW kx lk šX/ *kiʔtx* 'to be funnel-shaped', *knooʔkW* 'to be concave (deep)', ...*Xaʔkx* '...and the.', *kamiʔlk* 'to plane (pl.)', *kpeeʔšX* 'to be concave (shallow)'.

With /f/ as the filler of C¹, the following occur as fillers of C²C³: /pk tx lk šX/ ...*ʔiifpk* '...my arrival.', *koftx* 'coral snake', *ʔaflk* 'knee', *kaafšX* 'to go fast'.

With /l/ as the filler of C¹, the following occur as fillers of C²C³: /kW Xk/ *kXolkW* 'to sip', ...*yaailXk* '...left them alone.'.

With /X/ as the filler of C¹, the following occur as fillers of C²C³: /pX kW l̩k l̩X šk/ *ρpomáXpX* 'don't be angry with me!', *kšooXkW* 'to be four', *PaXl̩k* 'projectile points', ...*paρkóXl̩X* '...if one is with him.', ...*PaXšk* '...the dog.'

With /W/ as the filler of C¹, the following occurs as filler of C²C³: /kW/ *PaWkW* 'species of eel'.

With /s/ as the filler of C¹, the following occur as fillers of C²C³: /pX tx kt kl̩ kW xk/ *Paák imapáspX* 'it is filthy', *istx* 'leaf', *PaSkT* 'lung', *kooskl̩* 'to be gray', *XatóskW* 'mud hen', *knoosxk* 'to be rough (pl.)'.

With /š/ as the filler of C¹, the following occur as fillers of C²C³: /kt kš l̩k xk Xl̩/ *k^waiškt* 'come in (pl.)!', *Paškš* 'my younger brother (m.s.)', *kiPašl̩k* 'to be dirty', *naxkáášxk* 'species of bush', *kaášXl̩* 'to cough'.

With /X^w/ as the filler of C¹, the following occurs as filler of C²C³: /kW/ *kosiX^wkW* 'to fillet'.

With /m/ as the filler of C¹, the following occur as fillers of C²C³: /tx tX^w l̩k xk xX šx/ *Pa^mtx* 'tendon', *komtX^w* 'to be straight', *Pa^{tá}am̩k* 'temples (of head)', *kamxk* 'bring it!', ...*k^wPa^óm̩xX* '...if we don't have it.', *Pa^mW iPa^{kó}om̩šx* 'tape worms'.

With /n/ as the filler of C¹, the following occur as fillers of C²C³: /pX tš tX kl̩ l̩k l̩X xk šX/ *kosáanpX* 'to race', *eentš* 'knives', *PaⁿtX* 'base', *tinkl̩* 'species of plant', *kmoonl̩k* 'to be wavy', *kinl̩X* 'to be empty-handed', *kokmóonxk* 'to be zigzagged', *kpaⁿšX* 'to run'.

With /ŋ/ as the filler of C¹, the following occurs as filler of C²C³: /xk/ *Pa^{tá}l̩Xl̩kkoon̩xk* 'brothers-in-law (m.s.)'.

7.3. Four-consonant sequences occurring syllable initially are described by stating the filler of the C⁴ slot in the formula C⁴C³C²C¹V-, plus the fillers of the C³C²C¹ slots with which it combines.

With /k/ as the filler of C⁴, the following occur as fillers of C³C²C¹V-: /Wtm Wsp Wst Wsk Wsm/ *kWtmeet* 'did he believe it?', *kWspátxkkaPa* 'it is going to spread', *kWstépkapa* 'it is going to be vegetation', *kWskitóix* 'let's return for it', *kWsmóonxkkaPa* 'it is going to be zigzagged'.

With /ρ/ as the filler of C⁴, the following occur as fillers of C³C²C¹V-: /ptk^w psp psk^w/ *Pa^ρtk^wqPa^ápliPo* 'I'm not cold', *Pa^ρspáansXis* 'Of course I will run', *Pa^ρsk^wáqaxkXo* 'I'm not going to yawn!'.

Four-consonant sequences occurring syllable finally are described by stating each filler of the C¹ slot in the formula -VC¹C²C³C⁴, plus the fillers of the C²C³C⁴ slots with which it combines.

With /p/ as the filler of C¹, the following occurs as filler of C²C³C⁴: /WkW/ *Pa^ρotípWkW* 'squeeze me!'.

With /t/ as the filler of C¹, the following occur as fillers of C²C³C⁴:
/Wk^wW X^wk^wW/ *tootWk^wW* 'cholla cactus', *PatX^wk^wW* 'penis'.

With /k/ as the filler of C¹, the following occur as fillers of C²C³C⁴:
/Wík Wsx/ *PyakWík* 'my ankle bones', *kookWsx* 'to shake off'.

With /ʔ/ as the filler of C¹, the following occurs as filler of C²C³C⁴:
/Wk^wW/ *kooʔWk^wW* 'to be vertical (pl.)'.

With /m/ as the filler of C¹, the following occurs as filler of C²C³C⁴:
/Wk^wW/ *kimWk^wW* 'to think (pl.)'.

8. VOWEL DISTRIBUTION

Any vowel may occur in syllable initial, medial, or final position: *it* 'trunk', *exkkemme* 'to be lazy', *oták* 'toad', *átta* 'his mother'; *kip* 'to dig up', *Pek* 'my daughter (m.s.)', *kops* 'firefly', *Pap* 'mule deer'; *kópni* 'species of fly', *kíippe* 'to be good', *ʔááʔʔo* 'road', *ókka* 'now!'.

Vowels occur in sequences of two identical or diverse vowels, in sequences of three identical or diverse vowels or combinations of these, and in sequences of four which are combinations of identical and diverse vowels.

Sequences of two and three identical vowels are phonemically in contrast with single vowels and with each other and are structurally analogous to sequences of diverse vowels. The following four sets of examples show contrasts of stressed vowel nuclei within the range of sequences of identical vowels: *ʔíttoox*¹⁶ 'my eyes', *ʔíitoŋ*¹⁷ 'my speech', *ʔíiitiŋ* 'my efforts'; *ʔéppenŋ* 'white tail deer', *kéetiŋ* 'to build up side of basket for extra load', *kéeeetiŋ* 'to lie (rep.)'; *kóʔʔa* 'to have', *kóotso* 'to hiss (tpl.)', *kóooWk^wiŋ* 'to bark (rep.)'; *káttool* 'to be wild', *káatiŋ* 'to use', *káaatiŋ* 'to talk excessively'.

An unstressed vowel nucleus of two identical vowel occurs in phonemic contrast with an unstressed nucleus consisting of a single vowel: *ʔíttoox* 'my eyes', *ʔíttox* 'our mothers'.

All possible combinations of two identical or diverse vowels occur, except /ae/.

Syllable initially the following combinations of two vowels occur: /ii oi ee ea oi oe oa oo ai aa ao/ *iif* 'his nose', *tonam* 'his hat', *eesW* 'go barefoot!', *eamW* 'lightning', *oin* 'his mouth wad', *oen* 'his family'

¹⁶ A nucleus consisting of a single stressed vowel is only rarely followed by a single consonant when that consonant occurs in utterance medial position. *ʔóšala* 'sic 'em!'

¹⁷ A sequence of two identical vowels is phonetically shorter before geminate consonants than in other environments, *ʔíttix* 'get shallow!', *kéepox* 'horned shark', *kóoʔʔa* 'to cry', *káatiŋ* 'to bake in ashes (rep.)'.

óaktij 'his equipment', *ool* 'organ pipe cactus', *ait* 'dance!', *aasx* 'species of lizard', *aokš* 'trot!'.

Syllable medially all possible combinations of two vowels occur, except /ae/: *kiikkeet* 'to bear a child', *piest* 'fiesta', *Ṗionam* 'my hat', *ṖssiaṖa* 'I'm going to smell it', *Ṗatéiktij* 'rag' (only example attested), *kéetteex* 'to peel', *kkeokl* 'to listen', *tear* 'evil spirit', *koil* 'to be blue', *toerk* 'willet', *kóoXXi* 'to die (animal)', *kóanla* 'tarantula', *Ṗait* 'blood', *Ṗáonam* 'hat', *ṖáassaaX* 'rat's nest'.

Syllable finally the following combinations of two vowels occur: /ii ee ea oi oo ai aa/ *kii* 'to hear', *kee* 'species of duck', *sea* 'teddybear cholla' *koi* 'still, yet', *koo* 'guitar fish', *Ṗai* 'wind', *kkaa* 'to look for'.

Three-vowel sequences occur syllable initially, medially and finally.

Syllable initially the following combinations of three vowels occur: /iii eee eaa oai oaa aai/ *íiitij* 'to do for the first time', *eeet* 'deny it!', *eaax* 'vertebrae', *oai* 'to do (pl.)', *oaaf* 'waist cord', *áaitox* 'fish (pl.)!'.

Syllable medially the following combinations of three vowels occur: /iii iia iao eee eoi eaa oii oee oeo ooi ooo oai oaa aii aia aio aoa aai aao/ *Ṗíiitij* 'my efforts', *skonsliaṖa* 'I'm not going to smell it', *kláoto* 'neck hump of bull', *kéeto* 'to deny (pl.)', *Xéppe óil* 'coral sea fan', *koféaakol* 'to have good sight (pl.)', *kamóix* 'to play fiesta game', *Ṗóetax* 'children', *Ṗatóeokl* 'big toes', *kokóoiX* 'to win race', *kóooWk^{wij}* 'to bark (rep.)', *koaix* 'to hang still', *toaas* 'handkerchief', *káitij* 'to awaken (rep.)', *Ṗai an iṖlix* 'ship's compass', *Ṗaio káaix* 'to flicker', *Xíkka óanlox* 'their equipment', *káaitij* 'to make (rep.)', *káaoitij* 'to pass by (rep.)', *káaatij* 'to call (rep.)'.

Syllable finally the following combinations of three vowels occur: /iii iai eee eaa oii oee oai oaa aii aai aao/ *kiii* 'to hear (pl.)', *Ṗti klai* 'pair', *kapWéee* 'to slander', *koféaa* 'to have good sight', *koii* 'to be seated (pl.)', *Ṗoee* 'baby', *ṖáX ano kóai* 'to wash clothes (pl.)', *kiXóaa* 'to fight', *kaii* 'elder', *Ṗapáai* 'Papago', *kaao* 'to pass by'.

Four-vowel sequences occur syllable medially and finally.

Syllable medially the following combinations occur: /iaia iaai oiia oaii oaia aiia aiaa aaia aaoi/ *isíaiaṖa* 'he is going to go to bring it', *kláaitij* 'to go to (rep.)', *yéeno PasóiaṖa* 'we're going to go ahead', *Ṗatoa úšk* 'sole of foot', *Ṗánt oai ánniipXat* 'walk home (pl.)!', *Tót kṖispáiaṖa* 'Tot is going to use it', *ṖaiáaṖa* 'it is really windy', *isáiaiaṖa* 'he's going to do it', *ipáao impáaṖa* 'there is no way to get through'.

Syllable finally the following combinations occur: /iaai oiio oaii oaii aaio/ *kliaai* 'to cost', *ṖakX kóioo* 'to be lying around loose', *ṖákkiiXo áii* 'stop (pl.)!', *koaai* 'to hunt head lice', *mos Ṗáaio* 'do it again!'.

A syllable may consist entirely of vowels: *íí* 'yes', *eaai* 'sounds'.

9. HIGHER-LAYER PHONOLOGICAL UNITS

Higher-layer units include breath groups, pause groups and stress groups.

The breath group is a unit of speech uttered between consecutive inhalations and contains one or more pause groups. In Seri narrative text, breath groups frequently consist of a single long pause group, with pronounced inhalation at the onset and diminution to low pitch and minimum intensity at the end.

The pause group is a unit of speech uttered between consecutive pauses, is coterminous with an intonation contour, and contains one or more stress groups. Pause groups containing as many as twenty-one stress groups have been transcribed in Seri text.

The stress group is a unit of speech characterized by a single peak of stress, and contains one or more syllables. The peak of stress, according to our transcription of field data, seems to be a composite of intensity, high pitch, and length (either of vocalic nucleus or post-vocalic margin), and it may occur on any syllable of the stress group. Such a peak, for this language, proved to be the relevant signalling component of the stress group since, in text, borders are usually indeterminate, and stress groups become fused into higher phonological units. In a long pause group, features of pitch and rhythm may be the only phonological criteria available for determining stress group borders.

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