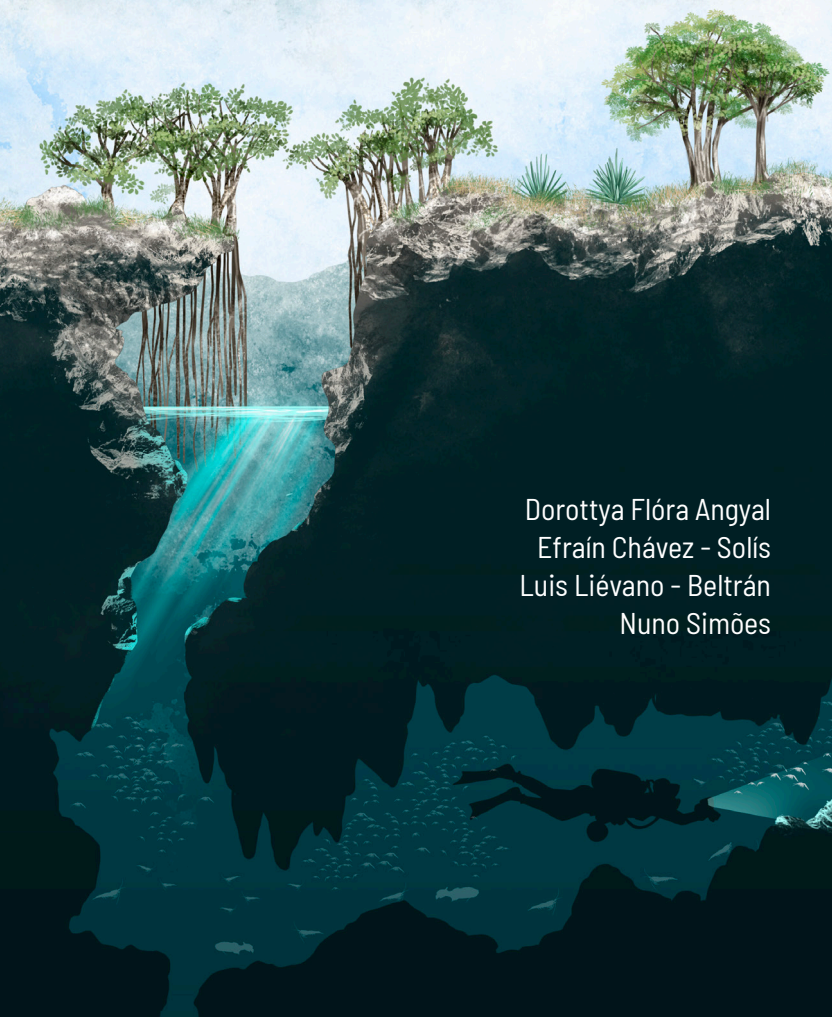


Tsol ts'íib seebak utia'al u k'ajóolta'al:

Ba'alche'ob yano'ob yáanal lu'um tu ts'ono'otilo'ob u Petenil Yucatán

Dorottya Flóra Angyal
Efraín Chávez - Solís
Luis Liévano - Beltrán
Nuno Simões



Ch'íibalilóob "estigobiontes" (u k'aaba'é ku taal ti' Stýx, jump'éeel bel ja' griego ti' Xibalbá yéetel bios, kuxtalil) leti'obe' ku kajtalo'ob tu ja'il yáanal lu'um, je'el bix u áaktunilo'ob beeyxan ts'onóoto'ob tu Petenil Yucatán. U ya'abilo'ob estigobiontesé' wayilo'obe', yaan jach chichan tu'ux kaja'ano'ob chéen ti' jump'éeel áaktun kuxa'ano'ob, ti' le k'iino'oba' 15% ti' le yano'ob tu Petenil Yucatán ta'aytak u xu'ulsalo'ob.

Estigobiontesé' ku k'éexpajal u kuxtaloob ku ya'ala'ale' troglomorfismo, lelo'; u k'áat u ya'ale' ba'alo'ob yaan ti'ob ikil k'éexpaj u kuxtalo'ob yanaal lu'um, lelo' ku yila'al u jela'anil yéetel le yano'ob yóok'olkabó'. U k'éepajal u wiinkililo'obe' jach séebak u yila'al. Yano'obe' ku páatal mináan u yicho'ob, u chowaktal u k'abo'ob yéetel u yooko'ob beeyxan u saktal u wiinkilalo'ob. Chéen ba'ale' yaan k'iin xane' ku k'éexpajal u kuxtalo'ob lelo' ku k'exbesik u báak'pachil tu'ux kaja'ano'ob lelo' ku beetik u páajtal u kuxtalo'ob ich éek'joch'éenil, tu'ux mináan sáasilil.

U ba'alche'ilo'ob estigobiontesé' ku beetiko'ob meyajóob yéetel u ba'alilo'ob yo'kabil, je'el bix u beeta'al u la'abal, lelo' u k'áat u ya'ale' ku sutk'esiko'ob sojol tukukbal ichil le kúuchilo', u xu'ulsiko'ob ik'elo'ob ku taasiko'ob k'ojá'anilo'ob beeyxan u péeksiko'ob ba'alo'ob ku k'askúuntiko'ob yóok'olkab. Le beetike', jach k'ána'an utia'al u yantal yéetel u meyaj ma'alob le kúuchil ja'ó'. Tu kúuchil Cenoteando, táan k tuklike' ka'ansajile' u bejil utia'al u meyajta'al yéetel u kaláanta'al ts'onóoto'ob beeyxan u ja'il yóok'olkab.

Le beetikee', le tsol tsikbala' séebak utia'al u k'ajóolta'al estigobiontes jump'éeel muk' meyajil utia'al u ts'aabal náatbil le kuxtal yaan yáanal lu'umó'. Ma' tukulta'ab u beeta'al chéen bey jump'éeel péeksaj óole' yéetel ku ye'esik chéen u ba'alche'ilo'ob séebak je'el u páajtal u k'ajóoltale', beeyxan chéen wáa jaytúul jach jela'antako'ob.

Le ts'íib ju'unila' beeta'ab yéetel u áantaj taak'inil PAPIIT IN222716 "Biodiversidad y Ecología de la fauna de cenotes de Yucatán" and PAPIIT 2019 - IN228319 "Hacia un mapa de biodiversidad acuática de cenotes de la península de Yucatán" liderado por N.S. D.F.A. está agradecida por la beca recibida de "DGAPA-UNAM Programa de Becas Posdoctorales en la UNAM 2020".

Boonilo'ob: Eduardo Velázquez yéetel Alberto Guerra.

U boonilo'obe' beeta'ab yéetel u meyaj oochelilo'ob, k'u'ub tumeen, Benjamín Magaña, Efraín Chávez-Solis, Dorottya Flóra Angyal, Luis Liévano-Beltrán, Brett González, Francisco Solis-Marín, Jozef Grego y Fernando Álvarez.

Ts'íita'ab ich maaya tumeen José Manuel Tec Tun.

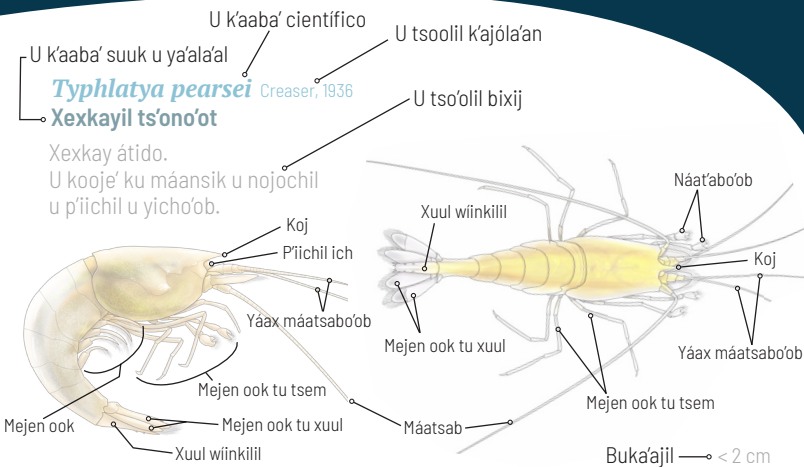
U wáal ju'unil tu'ux ku yila'al u Molay Xak'almeyaj "Cenoteando" of the UNAM UMDI-Sisal:

www.cenoteando.mx



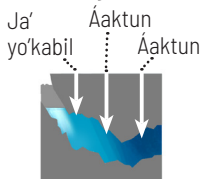
Bix je'el u meyajta'al le tsol ts'íiba'

Ch'í'ibalilóob ku yila'al te'ela' tiano'ob ichil u jejeláasil ba'alche'ob *estigobiontes*, yané' mina'an u baakelo'ob yéetel u jeelo'obe' yaan u baakelo'ob. Tí' junjuntuúliil u ch'í'ibalilóobe', ku ts'aabal u k'aaba' *científico* yéetel u k'aaba' suuk u ya'ala'al t'í'ob, bix u kuxtalo'ob, tu'ux yano'ob yéetel mejen kúuchilóob tu'ux kaja'ano'ob, bix u kaláanta'al tí' le k'íino'oba' yéetel bix u yila'al u wiinkilal. Tí' le súutukila', ku ye'espajal bix je'el u meyajta'al le tsol ts'íiba'.



U chiikulil

U kúuchil ja'



Ba'ax ku jaantiko'ob



Mejen xiiwo'ob yéetel ikelo'ob



Xiiwo'ob yéetel kuuxum



Ba'alo'ob yaan yook'olkab



U ta' soots'ob yéetel ch'íich'ob



Kimen ba'alche'ob



Ikelo'ob yaan u sóol

Ti' ba'ax ja'il



U tsoolil bix u kaláanta'al



Tu'ux ku yantal



Yáanal tuunicho'ob



Yóok'ol tuunicho'ob



Jooló'ob ich u xiixel sojol



Yóok'ol u xiixel sojol



Tu bel ja'



LC Ma' jach tukultbil'

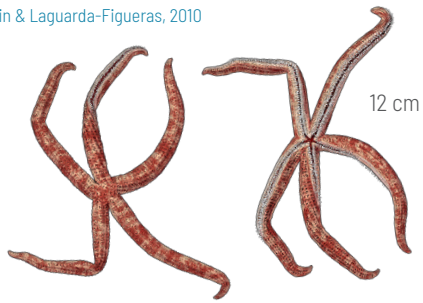
NT Táan u taal u xu'ulul

En Péek óol u xu'ulul

Copidaster cavernicola Solis-Marin & Laguarda-Figueras, 2010

Eek'il áaktun

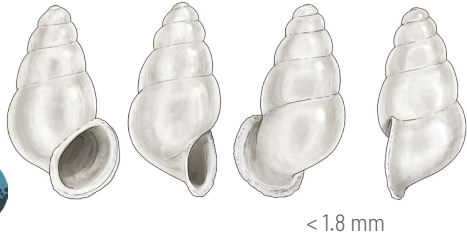
Chéen jump'éel eek'il k'áak'náab *estigobionte* yaan yóok'olkab, chéen kuxa'an tí' jump'éel áaktun tu lu'umil Cozumel.



Mexicanotica xochii Grego, Angyal & Beltrán, 2019

Ch'óop jub

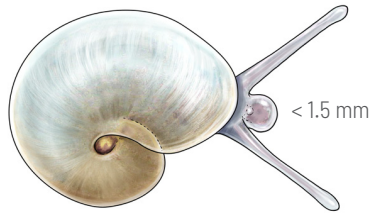
Mejen jub, ts'aab u k'aaba' jéel bix u ts'onó'otil tu'ux kaxta'abij.



Teinostoma brankovitsi Rubio, Rolán, Worsaae, Martinez & Gonzalez, 2016

U jubil áaktun

Chan jub yaan u sóol chichan, yaan u k'oomk'omil. Lelo' ku ya'alale' tumeen yaan tí' u xiixel ba'alo'ob yaan ichil u áaktunilo'ob tu jaal k'áak'náab.

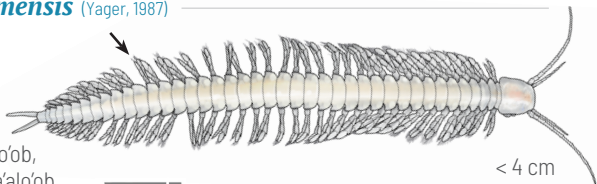


Xibalbanus tulumensis (Yager, 1987)

Báab ookil

Le báab ookilo'obo' u yikelo'ob ja' jach yaan u k'i'inam.

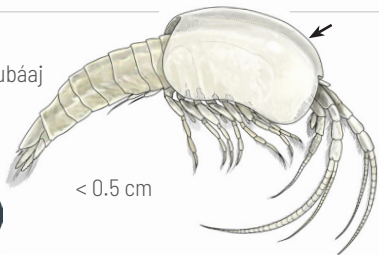
Leti'obe' kajam koobolo'ob, ku ya'alale' úuchben ba'alo'ob kuxa'ano'ob. U k'aaba'ée' u k'áat u ya'ale' ku báabo'ob yéetel u yooko'ob.



Tulumella unidens Bowman & Iliffe, 1988

Xexkay p'óokil áaktun

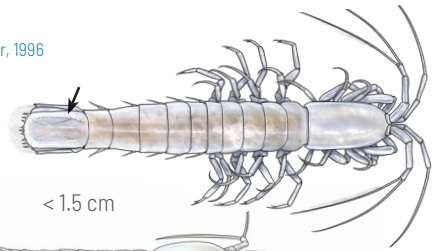
Chan iik'el yaan u sóol, ku kuxtal tu'ux ku nupikubáaj ch'óoch' ja' yéetel ch'ujuk ja' ich áaktuno'ob. U mejenile' ku kuxtalo'ob ichil jump'éel mukuk yaan tu paaach u na'tsil.



Stygiomysis cokei Kallmeyer & Carpenter, 1996

Nojoch Estigiomísido

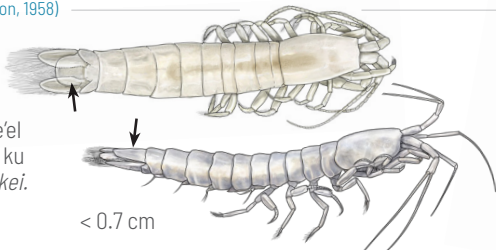
Chan iik'el yaan u sóol, chowak u wiinkilil u xuul u wiinkilile' ka' wáal u chowakil ti' u kóochil. U nuuktakilo'obe' ku p'ísiko'ob óolí' ka' wáal *S. holthuisi*.



Stygiomysis holthuisi (Gordon, 1958)

Chan Estigiomísido

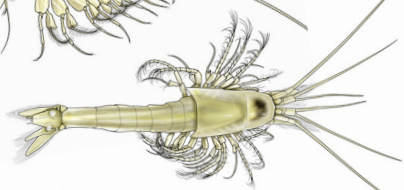
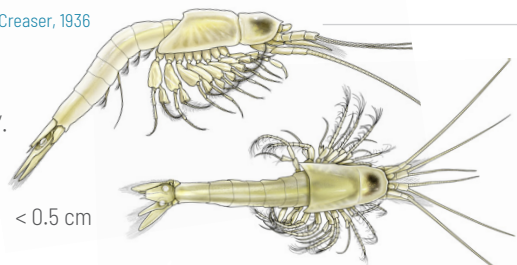
Chan iik'el yaan u sóol, chowak u wiinkilil u xuul u wiinkilile' kóoch je'el bix u chowakilé'. U nuuktakilo'obe' ku p'ísiko'ob táan chúumukil of *S. cokei*.



Antromysis cenotensis Creaser, 1936

Mejen xexkayil ts'ono'ot

Mejen xexkay. Lelo'oba' jach yaan tu ts'ono'otilo'ob ch'ujuk ja'. U mejenile' ku kuxtalo'ob ti' jump'eel mukuk yaan tu chuun u nak u na'nsil.

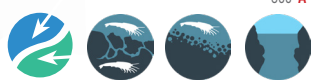
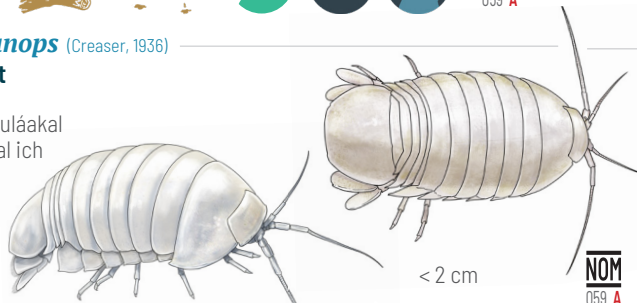


NOM
059 A

Creaseriella anops (Creaser, 1936)

Mukayil ts'ono'ot

Mukay ku jaantik tuláakal ba'al, jach ku yantal ich ts'ono'oto'ob. Utia'al u ta'akikubáae' ku wolkubáaj.

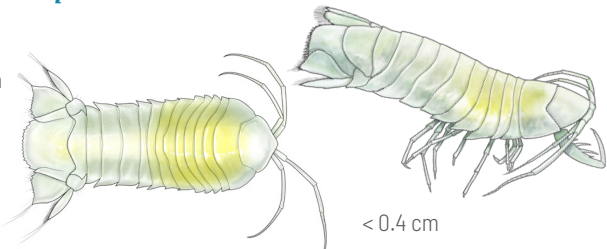


NOM
059 A

Yucatalana robustispina Botosaneanu & Iliffe, 1999

Mukayil ts'ono'ot

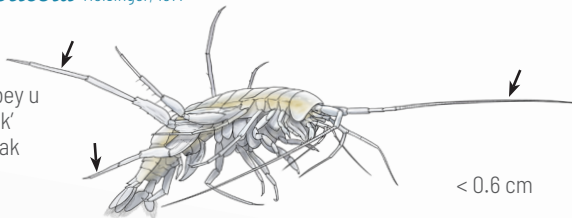
Mukayil jach chichan ma' je'el bix *C. anops*. U wiinkilile' chowak ts'o'okole' ma' tu paajtal u wolkubaaaj.



Mayaweckelia cenoticola Holsinger, 1977

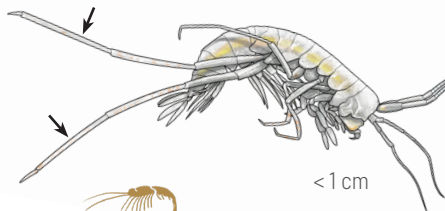
Xexkayil ts'ono'ot

Xexkayil ch'ujuk ja'. U yaax maatsabe' laayli' bey u chowakil u wiinkilile', u lak' u mejen ooko'obe' koomtak ma' bey u wiinkilile'.



Mayaweckelia troglomorpha Angyal, 2018

Xexkayil ts'ono'ot



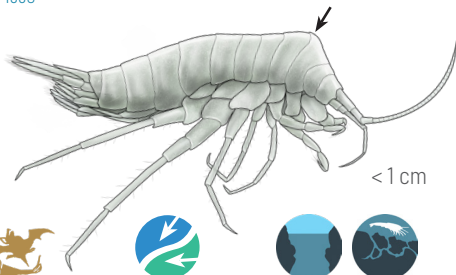
Xexkayil ch'ujuk ja'. U yaax maatsabe' ka' waal u chowakil u wiinkilil, ts'o'okole' u lak' u mejen ooko'obe' maanaj u chowakil ti' u wiinkilil.



Tuluweckelia cernua Holsinger, 1990

Xexkay yaan u puus

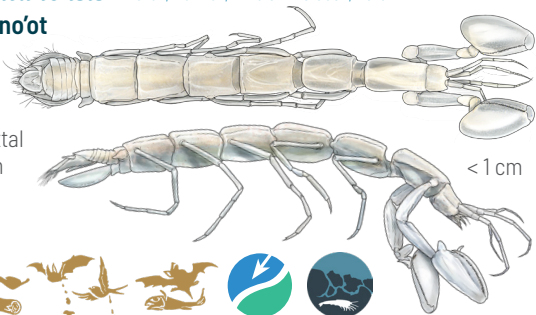
Xexkayil ch'ujuk ja' yeetel ch'ooch' ja'. U taanil u wiinkilile' ku puunul kaabal bey wa yaan u puuse'.



Curassanthura yucatanensis Álvarez, Benitez, Iliffe & Villalobos, 2019

Mukay ts'awayak'il ts'ono'ot

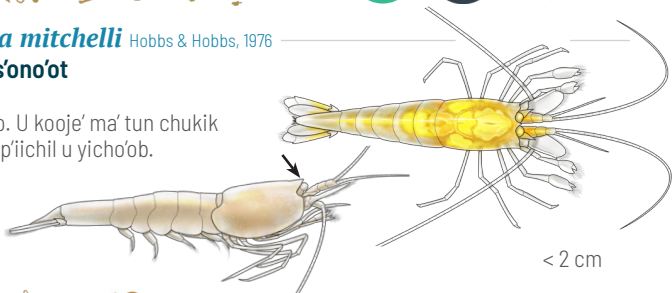
Mukay túuts' u wiinkilil yéetel chowak , je'el bix u wiinkilile' ku ye'esik ku kuxtal ich joolo'ob chowak wa ich tuunich'o'ob.



Typhlatya mitchelli Hobbs & Hobbs, 1976

Xexkayil ts'ono'ot

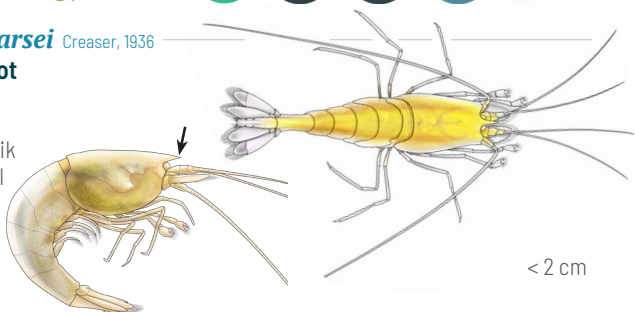
Xexkay átido. U kooje' ma' tun chukik u nojochil u p'iichil u yich'o'ob.



Typhlatya pearsei Creaser, 1936

Xexkayil ts'ono'ot

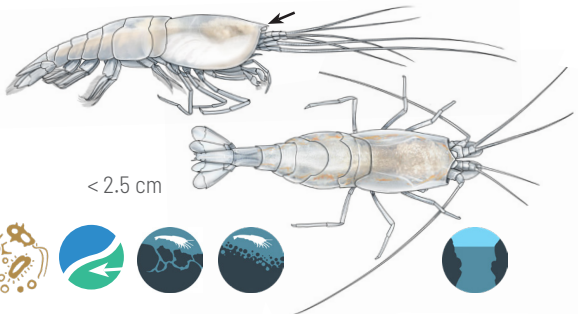
Xexkay átido. U kooje' ku ma'nsik u nojochil u p'iichil u yich'o'ob.



Typhlatya dzilamensis Álvarez, Iliffe & Villalobos, 2005

Xexkayil ts'ono'ot

Xexkay átido. U kooje' ku chukik u nojochil u p'iichil u yich'o'ob.

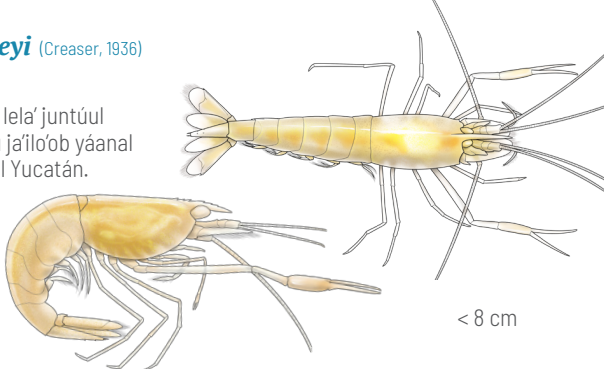


Creaseria morleyi (Creaser, 1936)

Chakayil ts'ono'ot

Yik'el ja' yaan u so'ol, lela' juntúul u nojochil kuxa'an tu ja'ilo'ob yaanal lu'um yaan tu Petenil Yucatán.

Ku jaantik ulak' ba'alche'ob, cheén wa jach mina'an ba'al u jaante' ku jaantik tulákal ba'al yaan ichil le ja'ó'.



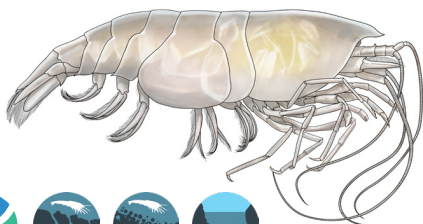
< 8 cm



Yagerocaris cozumel Kensley, 1988

Xexkay ku juum

Lela' cheén juntúullili', óoli' ma' K'ajóola'ani'. Kajam kobol cheén tu ja'il yaanal lu'um ku kuxtal.



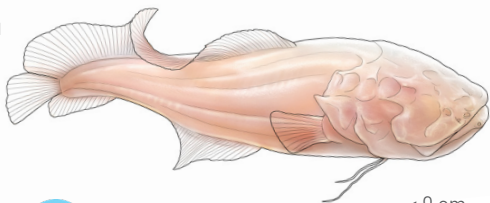
< 2 cm



Typhlias pearsei (Hubbs, 1938)

Sak xunáan ch'óop

U kayil ch'ujuk ja' u ch'i'ibale' ku kuxtal tu taamil ja'ob. Yéetel u kan kayil ch'óop yaan tu lu'umil Yucatáne', ku jaantik ulak' ba'alche'ob ku kuxtalo'ob ich ts'onóoto'ob.



< 9 cm



Ophisternon infernale (Hubbs, 1938)

Kan kay ch'óop yucatanil

Jats'uts u wiinkilil le kan kaya', táaytak u xu'ulul u kuxtal. Ku beetik u jooló'ob ichil u xiixel ba'aló'ob yéetel ku yila'al cheén ti' wáa jaypéel ts'onóoto'ob.



< 30 cm





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