

A comparison of contributions from the Aztec cities of Tlatelolco and Tenochtitlan to the bird chapter of the *Florentine Codex*

Una comparación de las contribuciones de las ciudades aztecas de Tlatelolco y Tenochtitlan al capítulo de aves del *Códice Florentino*

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Abstract

The *Florentine Codex* is a Renaissance-era illuminated manuscript that contains the earliest-known regional work on the birds of México. Its Nahuatl language texts and scholia (the latter later incorporated into its Spanish texts) were written in the 1560s by Bernardino de Sahagún's research group of elite native Mexican scholars in collaboration with Aztecs from two cities: Tlatelolco and Tenochtitlan. In the present study, I compared the contributions from these two cities and found many differences. While both cities contributed accounts and descriptions of land and water birds, those from Tlatelolco were mainly land birds, while those from Tenochtitlan were mainly water birds. Tlatelolco contributed over twice as many bird accounts as Tenochtitlan, and supplied the only information about medicinal uses of birds. Tenochtitlan peer reviewed the Tlatelolco bird accounts and improved many of them. In addition, Tenochtitlan contributed all information on bird abundance and most information about which birds were eaten and not eaten by humans. Spanish bird names appear more frequently in the Aztec language texts from Tenochtitlan. Content analysis of the Tenochtitlan accounts suggests collaboration with the water folk *Atlaca* (a prehistoric lacustrine culture) and indigenous contacts with Spanish falconers. The Renaissance-era studies of Sahagún's research group, on a now lost island in the formerly vast, bird-rich wetlands of the Valley of México, constitute the birth of Mexican ornithology and, coincidentally, give the history of Mexican ornithology a distinctive, Aztlán-like beginning, significantly different from the ornithological histories of neighboring countries.

Keywords: Atlaca, avifauna, Aztec, birds, history, Mexico, Nahua, ornithology, science, Sierra de los Tuxtlas.

Resumen

El *Códice Florentino* es un manuscrito iluminado de la época del Renacimiento; contiene el primer trabajo regional conocido sobre las aves de México. Sus textos en lengua náhuatl y scholia (este último posteriormente incorporado a sus textos españoles) fueron escritos en la década de 1560 por un grupo de ayudantes de Bernardino de Sahagún, estudiosos mexicanos, nativos de élite, en colaboración con los aztecas de dos ciudades: Tlatelolco y Tenochtitlan. En este estudio comparé las contribuciones de cada una de las ciudades y encontré muchas diferencias; aunque ambas presentaron conteos y descripciones tanto de aves terrestres como acuáticas, en los estudios de Tlatelolco había principalmente aves terrestres, mientras que las de Tenochtitlan, aves acuáticas. Tlatelolco contribuyó con más del doble de conteos de aves que Tenochtitlan y aportó la única información sobre usos medicinales de las aves. En Tenochtitlan se revisaron los conteos de aves de Tlatelolco y se mejoraron muchos listados. Además, Tenochtitlan proporcionó la información sobre la abundancia de aves, así como de las que eran consumidas por los pobladores. Los nombres en español de las aves aparecen con más frecuencia en los textos de Tenochtitlan. El análisis de los conteos de las aves de Tenochtitlan sugiere la colaboración de la gente del agua: Atlaca (cultura lacustre prehistórica) y los contactos indígenas con halconeros españoles. Los estudios de la época renacentista del grupo de ayudantes de Sahagún, en una isla perdida en los antiguos y vastos humedales de aves del Valle de México, constituyen el nacimiento de la ornitología mexicana y, coincidentemente, dan a la historia de la ornitología mexicana un distintivo, Aztlán –como comienzo, significativamente diferente de las historias ornitológicas de los países vecinos.

Palabras clave: Atlaca, aves, avifauna, azteca, ciencia, historia, pájaros, ornitología, mexicana, México, Sierra de los Tuxtlas.

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Introduction

A half century after the historic meeting of Cortés and Montezuma II in 1519, the Aztec capital Tenochtitlan was the scene of yet another important meeting: the formal peer review, revision and expansion of the earliest known regional work on Mexican birds. That manuscript, which when improved would eventually become part of the Renaissance-era illuminated encyclopedia known today as the *Florentine Codex* (Sahagún [1577] 1979), was produced by Bernardino de Sahagún's research group of elite native Mexican scholars (Appendix A) in collaboration with Aztec leaders.

The rough draft scrutinized by the peer reviewers in Tenochtitlan had been written earlier by the research group during its fieldwork in Tlatelolco during the years 1561-1565. There, they had collaborated with "very capable" Aztec leaders to produce a manuscript describing "the better known and most utilized...birds" of México (Sahagún [1577] 1982, pp. 54, 87). Now, in Tenochtitlan, during the year 1569, the research group presented their Tlatelolco draft (known today as the *Manuscript of Tlatelolco*) to a similar group of knowledgeable Aztecs (Appendix B) for examination, amendment and expansion (Sahagún [1577] 1982).

As in Tlatelolco, the "principal and wisest" of the research group's four native scholars, Antonio Valeriano, was present during "these scrutinies" (Sahagún [1577] 1982, p. 55). A renowned scholar from the *Colegio de Santa Cruz* in Tlatelolco, Valeriano was also a member of the Aztec dynastic family (Appendix C), so it is reasonable to assume that all doors to the past and present in the local indigenous community must have been open to the research group. Because the resulting product of the research group's work in Tenochtitlan would be a revised manuscript written in the Aztec language (Classical Náhuatl), lacking only the scholia and Spanish translations (both of which would later be included in the *Florentine Codex*), three scribes were hired to write a new and clear copy of the research group's manuscript (Appendix D). This new manuscript, known today as the *Manuscript of 1569*, is now lost. However, during the 1570s, its texts were copied into the *Florentine Codex* (Sahagún [1577] 1979, 1982), enabling us today to fully access all of its texts.

What little we know about this earliest-known ornithological project in México, including all the above information, comes from prologues that the research group wrote to various books of the *Florentine Codex* (Sahagún [1577] 1979, 1982, 1988). However, it is possible to discover still more facts about their work by studying the content of the various bird accounts that they wrote (Appendix E).

Accordingly, in the present paper, I use content analysis of the bird accounts, combined with the comparative method, to discover significant new information about the historic ornithological project of Sahagún's research group. Specifically, I ask and answer the following new question: Did the contributions of the Aztecs from Tenochtitlan differ from those of Tlatelolco and, if so, how did they differ?

Methods

Sahagún wrote that after his research group produced the *Manuscript of Tlatelolco*, there was only one occasion when new information was added to their work: the above described peer review and collaboration in Tenochtitlan (Sahagún [1577] 1982, p. 55). In contrast, he wrote that there were two occasions when amendments to the manuscript were made: (1) When Sahagún "alone, examined and re-examined" the group's writings at the Monastery of San Francisco de México during the years 1566-1569, and (2) during the above-described peer-review in Tenochtitlan (Sahagún [1577] 1982, p. 55). Therefore, Sahagún's own words suggest that we can identify contributions which are undeniably from Tenochtitlan's Aztecs by focusing our attention on additions rather than amendments.

The additions made in Tenochtitlan appear in two places in the *Florentine Codex*: (1) the Aztec texts and (2) the Spanish texts. Determining which information was added to the Aztec texts in Tenochtitlan is easy and straightforward: One simply subtracts the original Aztec texts of the *Manuscript of Tlatelolco* (Sahagún [1565] 1907, folios 248r-264r, 275v-276v) from the Aztec texts of the *Florentine Codex* (Sahagún [1577] 1963, 1979). What remains are the Aztec texts from Tenochtitlan.

Analyzing the Spanish texts of the *Florentine Codex* is more complicated because they contain two elements: (1) Spanish translations of select parts of the Aztec texts, and (2) the scholia (Appendix F). Assuming perfect Spanish translation, new information and critical comments appearing in the Spanish texts (*i.e.* information not present in the Aztec texts) come from the scholia. Scholia were written by Sahagún when he worked alone at San Francisco and also by the entire research group during the peer-review process in Tenochtitlan.

To determine which scholia came from Tenochtitlan, I subtracted from the Spanish texts of the *Florentine Codex* both the scholia written in the margins and spaces of the extant *Manuscript of Tlatelolco* (since we don't know for certain which of them were written when Sahagún "alone examined and re-examined" the group's writings), and the material in the Aztec texts that was translated into Spanish. After thus identifying in

the Spanish texts the scholia information from Tenochtitlan, I temporarily ignored those parts of it that were amendments, critical comments and opinions, and focused solely on those parts that are additions, because (as mentioned earlier) Sahagún's words suggest that the latter are unequivocally from the peer review and collaboration in Tenochtitlan. Summing this scholia information in the Spanish texts with the Aztec language accounts from Tenochtitlan (see below) gave me the total additions made by Tenochtitlan.

There is no evidence that Sahagún's research group wrote bird accounts during the years 1558-1561 when they worked in Tepepulco (Haemig 2012). None of the surviving Tepepulco manuscripts contain bird accounts (Sahagún [1561] 1993, 1997). I therefore assumed that all bird accounts in the *Manuscript of Tlatelolco* were written in Tlatelolco. If I am wrong on this point, it would mean that some of the accounts were peer-reviewed twice rather than once, for Sahagún wrote of the group's work in Tlatelolco that, "...for a year or more, all I brought written from Tepepulco was amended, explained and expanded" (Sahagún [1577] 1982, p. 54).

Results

Number of bird accounts

Tlatelolco contributed 108 bird accounts to the Aztec language texts of the *Florentine Codex*, while Tenochtitlan contributed 41 (Table 1, Table 2).

Foraging habitat of birds

Both cities contributed accounts of land birds and water birds (Table 1). However, most bird accounts from Tlatelolco described land birds, while most from Tenochtitlan described water birds (Table 2).

Physical descriptions of birds

One hundred forty-one of the 149 Aztec language bird accounts list physical characteristics of the birds which they describe (Table 1). All eight of the accounts lacking physical descriptions

Table 1. Aztec language bird accounts in Chapter Two and Chapter Three of Book Eleven of the *Florentine Codex*. Abbreviations: Tlat = Data from Tlatelolco, Tenoch = Data from Tenochtitlan, FC = *Florentine Codex* (Sahagun [1577] 1963, 1988), AT = Aztec Text, ST = Spanish Text, SIST = Scholia in Spanish Text. I ignored nine bird accounts in the third chapter (all from Tlatelolco) because they repeated birds (from Tlatelolco) covered in Chapter 2. I also omitted one account (*Acujtlachtli* B-3-27) because it described a mammal (See Appendix K). To determine from which city a bird account originated, I used the following procedure: All bird accounts in the *Manuscript of Tlatelolco* (Sahagun [1565] 1907, folios 248r-264r, 275v-276v) were assigned to Tlatelolco. All bird accounts found in Book Eleven of the *Florentine Codex* (Sahagun [1577] 1979) that were not also present in the *Manuscript of Tlatelolco* were assigned to Tenochtitlan. Two accounts (B-8-4 *Chiqujmoli* and B-8-5 *Chachalacatototl* or *Chachalacametl*) were assigned to Tenochtitlan because only the names of these birds are listed in the *Manuscript of Tlatelolco*. Their accounts were written in Tenochtitlan. If new information appeared first in the Aztec text of bird accounts from Tlatelolco, I regarded it as having originated in Tlatelolco. If new information appeared first in the Aztec text of accounts from Tenochtitlan, or in the Spanish text of any account, I regarded it as having originated in Tenochtitlan (via scholia added to the Spanish translations). No attempt has been made here to identify all species. For a summary of past attempts to identify the species of each account see Corona Martínez (2002) and Appendix of Haemig (2010).

Code Number for Aztec Text	Aztec Bird Name English literal translation or Onomatopoeic origin	Origin of Aztec Language Account	Foraging Habitat	Physical Description in Aztec Text	Abundance Data	Water folk and their cultural beliefs about birds mentioned	Eaten or Not-eaten by Humans	Spanish Bird Names in Aztec Texts	Comments
B-1-1	Quetzalototl Quetzal Bird	Tlatelolco	Land	Yes	-	-	-	-	
B-1-2	Tzinitzcan Tototl	Tlatelolco	Water	Yes	-	-	-	-	
B-1-3	Tlahquechol Red Quechol	Tlatelolco	Water	Yes	-	-	-	-	

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B-1-4	Xiuhquechol Turquoise Quechol	Tlatelolco	Not enough info	Yes	-	-	-	-	
B-1-5	Çaquan	Tlatelolco	Land	Yes	-	-	-	-	
B-1-6	Aioquan	Tlatelolco	Land	Yes	-	-	-	-	
B-1-7	Aioquan	Tlatelolco	Water	Yes	-	-	-	-	
B-1-8	Chalchiuhtotl Jade (Jadeite, Green Stone) Bird	Tlatelolco	Land	Yes	-	-	-	-	
B-1-9	Xiuhtotl Turquoise Bird	Tlatelolco	Land	Yes	-	-	-	-	
B-1-10	Xioapalquechol	Tlatelolco	Not enough info	Yes	-	-	-	-	
B-1-11	Xochitenacal Flower Tenacal	Tlatelolco	Land	Yes	-	-	-	-	
B-1-12	Quappachtotl Tawny Bird	Tlatelolco	Land	Yes	-	-	-	-	
B-1-13	Elutotl (Elototl) Ear of Corn Bird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-1	Toznene Yellow (or Parrot?) Doll	Tlatelolco	Land	Yes	-	-	-	-	
B-2-2	Toztl "Thing Very Yellow" (FC)	Tlatelolco	Land	Yes	-	-	-	-	
B-2-3	Alo	Tlatelolco	Land	Yes	-	-	-	-	
B-2-4	Cocho	Tlatelolco	Land	Yes	-	-	-	-	
B-2-5	Qujlton Little Herb; Little Greens	Tlatelolco	Land	Yes	-	-	-	-	
B-2-6	Tlacueçali	Tlatelolco	Land	Yes	-	-	-	-	

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B-2-7	Vitzizili (Onomatopoeic name, <i>uitzli</i> = thorn, a reference to beak?)	Tlatelolco	Land	Yes	-	-	-	-	
B-2-8	Quetzalhujtzilin Quetzal hummingbird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-9	Xihujtzili Turquoise Hummingbird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-10	Chalchihujtzili Jade Hummingbird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-11	Yiauhc Vitzili Dark (probably green) Hummingbird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-12	Tlapalhujtzili Red Hummingbird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-13	Aiopalhujtzili	Tlatelolco	Land	Yes	-	-	-	-	
B-2-14	Tlevitzili Fire Hummingbird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-15	Quappachvitzilin Tawny Hummingbird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-16	Hecavitzili Wind Hummingbird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-17	Totozcatleton Little Fiery-Throat	Tlatelolco	Land	Yes	-	-	-	-	
B-2-18	Telolovitzili Round Pebble Hummingbird	Tlatelolco	Land	Yes	-	-	-	-	
B-2-19	Yollototol Heart Bird	Tenochtitlan	Land	Yes	-	-	Eaten (Tenoch: AT, ST)	-	

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B-2-20	Pôpocales (Onomatopoeic name)	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: AT, ST)	Patos (Size model)	
B-2-21	Tecuĩltototl (Onomatopoeic Name)	Tenochtitlan	Not enough info	Yes	-	-	Eaten (Tenoch: AT, ST)	-	
B-2-22	Ixmatlatototl	Tenochtitlan	Land	Yes	-	-	Eaten (Tenoch: AT, ST)	-	
B-3-1	Canauhtli	Tlatelolco	Water	No	-	-	Eaten (Tenoch: SIST)	-	
B-3-2	Concanauhtli	Tlatelolco	Water	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-3-3	Canauhtli	Tlatelolco	Water	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-3-4	Canauhtil	Tlatelolco	Water	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-3-5	Tlalacatl	Tlatelolco	Water	Yes	"Many" (Tenoch: SIST)	-	Eaten (Tlat: AT) (Tenoch: ST)	-	Greater White-fronted Goose (<i>Anser albifrons</i>). Down used to make <i>Tilmatli</i> (AT). Quill feathers used as writing pens (ST).
B-3-6	Tocujlcoiotl	Tlatelolco	Water	Yes	-	-	Eaten (Tlat: AT) (Tenoch: ST)	-	Sandhill Crane (<i>Grus canadensis</i>)
B-3-7	Xomotl	Tlatelolco	Water	Yes	-	-	-	-	Feathers used to make <i>Tilmatli</i> (ST).
B-3-8	Teçolotli	Tlatelolco	Water	Yes	-	-	-	-	
B-3-9	Atotolin Aquatic Turkey Hen	Tlatelolco	Water	Yes	-	-	-	-	

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B-3-10	Quachilton Little Red Head	Tlatelolco	Water	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-3-11	Iacacintli Corn-nose or Corn-point	Tlatelolco	Water	No (AT) Yes (SIST)	-	-	Eaten (Tenoch: SIST)	-	
B-3-12	Vexocanauhtli Turkey-cock Duck	Tlatelolco	Water	Yes	-	-	-	-	
B-3-13	Açolin Water Quail	Tlatelolco	Water	Yes	-	-	-	-	
B-3-14	Atzitzicujlotl	Tlatelolco	Water	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-3-15	Acujcujalotl	Tlatelolco	Land	Yes	-	-	-	-	
B-3-16	Cujcujtzcatl	Tlatelolco	Land	Yes	-	-	-	-	
B-3-17	Aztatl	Tlatelolco	Water	Yes	-	-	Not Eaten (Tenoch: SIST)	-	
B-3-18	Axoquen	Tlatelolco	Water	Yes	-	-	-	-	
B-3-19	Quauhtotoli Wood or Tree Turkey Hen	Tlatelolco	Land	Yes	-	-	Eaten (Tlat: AT) (Tenoch: ST)	-	Wild Turkey (<i>Meleagris gallopavo</i>)
B-3-20	Atotolin Aquatic Turkey Hen	Tenochtitlan	Water	Yes	-	Water Folk: "heart of the lagoon", wind sorcery, sinks people, omen, "mirror".	Eaten (Tenoch: AT, ST)	-	
B-3-21	Acoiotl Water Coyote	Tenochtitlan	Water	Yes	"Rare" (Tenoch: AT, ST)	"All told of the <i>Atotolin</i> [B-3- 20] also applies similarly to the <i>Acoiotl</i> ." – FC (AT)	Eaten (Tenoch: AT, ST)	-	

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B-3-22	Acitli Water Hare	Tenochtitlan	Water	Yes	"Rare" Tenoch: AT, ST	Water Folk Wind sorcery	Eaten (Tenoch: SIST)	-	
B-3-23	Tenitztli Obsidian Bill	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: SIST)	Paloma (Size model, Leg model)	
B-3-24	Quapetlaoac Naked Head	Tenochtitlan	Water	Yes	"Quite Rare" (Tenoch: AT, ST)	Water Folk Omen	Eaten (Tenoch: SIST)	-	
B-3-25	Quatezcatl Mirror-head	Tenochtitlan	Water	Yes	"Rare" (Tenoch: AT)	-	-	Paloma (Size model)	
B-3-26	Tolcomoctli	Tenochtitlan	Water	Yes	-	Water Folk Portent	-	Capón (Size model)	
B-3-28	Covixin (Onomatopoeic name)	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: AT, ST)	Paloma (Size model)	
B-3-29	Icxixouhquj Green (or Blue-green) Legs	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: AT, ST)	-	
B-3-30	Quetzalteçolocton	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: AT, ST)	-	
B-3-31	Metzcanauhtli Moon Duck	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: AT, ST)	-	
B-3-32	Quacoztli Yellow Head	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: AT, ST)	-	Down used to make <i>Tilmatli</i> (AT).
B-3-33	Hecatototl Wind Bird	Tenochtitlan	Water	Yes	"Many" (Tenoch: AT, ST)	-	Eaten (Tenoch: AT, ST)	-	
B-3-34	Amanacoche "It has paper ear ornaments"	Tenochtitlan	Water	Yes	"Many" (Tenoch: AT, ST)	-	Eaten (Tenoch: AT, ST)	-	

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B-3-35	Atapalcatl	Tenochtitlan	Water	Yes	"Many" (Tenoch: SIST)	Water Folk Omen	Eaten (Tenoch: AT, ST)	-	
B-3-36	Tzitzioa	Tenochtitlan	Water	Yes	"Many" (Tenoch: AT)	-	Eaten (Tenoch: AT, ST)	-	
B-3-37	Xalquani Sand-eater	Tenochtitlan	Water	Yes	"Many" (Tenoch: AT)	-	Eaten (Tenoch: AT, ST)	-	
B-3-38	Yacapitzaoc Pointed-Nose	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: AT, ST)	-	
B-3-39	Tzonიაiauhquj	Tenochtitlan	Water	Yes	"Many" (Tenoch: AT, ST)	-	Eaten (Tenoch: AT, ST)	-	
B-3-40	Çolcanauhtli Quail Duck	Tenochtitlan	Water	Yes	"Many" (Tenoch: AT, ST)	-	Eaten (Tenoch: AT, ST)	-	
B-3-41	Chilcanauhtli Bright Red (Chili- red) Duck	Tenochtitlan	Water	Yes	"Many" Tenoch: AT, ST	-	Eaten (Tenoch: AT, ST)	-	
B-3-42	Achalalactli (Onomatopoeic name)	Tenochtitlan	Water	Yes	"Not very many... somewhat rare" (Tenoch: AT, ST)	-	Eaten (Tenoch: AT, ST)	-	
B-3-43	Iacapatlaoac Wide Nose	Tenochtitlan	Water	Yes	"Many" (Tenoch: AT, ST)	-	Eaten (Tenoch: AT, ST)	-	
B-3-44	Oactli (Onomatopoeic name)	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: AT, ST)	-	
B-3-45	Pipitzli (Name possibly derived from <i>pipitzca</i> = to cry, whinney, etc.)	Tenochtitlan	Water	Yes	-	-	Eaten (Tenoch: AT, ST)	-	
B-3-46	Acachichictli (Onomatopoeic name)	Tenochtitlan	Water	Yes	-	Water Folk Omen	Eaten (Tenoch: AT, ST)	Paloma (Egg model)	

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B-4-1	Quauhtli Eagle	Tlatelolco	Land	Yes	-	-	-	-	
B-4-2	Itzquauhtli Obsidian Eagle	Tlatelolco	Land	Yes	-	-	-	-	Replaced in the Spanish text by <i>Itzquauhtli</i> B-4-8 (Tenochtitlan).
B-4-3	Mixcoaquahtli Cloud-serpent Eagle	Tlatelolco	Land	Yes	-	-	-	-	Replaced in the Spanish text by <i>Mixcoaquahtli</i> B-4-10 (Tenochtitlan).
B-4-4	Iztac Quauhtli White Eagle	Tlatelolco	Land	Yes	-	-	-	-	
B-4-5	loalquahtli Nocturnal Eagle (FC)	Tlatelolco	Land	No	-	-	-	-	
B-4-6	Tlacoquahtli Half-eagle or Media Águila (FC)	Tlatelolco	Land	Yes	-	-	-	-	
B-4-7	Aquahtli Water Eagle	Tlatelolco	Water	Yes	-	-	-	-	
B-4-8	Itzquauhtli Obsidian Eagle	Tenochtitlan	Land	Yes	-	-	-	-	
B-4-9	Aitzquahtli Water Obsidian Eagle	Tenochtitlan	Water	Yes	-	-	-	-	
B-4-10	Mixcoaquahtli Cloud-serpent Eagle	Tenochtitlan	Land	Yes	"Many" (Tenoch: ST translates "lives everywhere" of AT as "many").	-	-	-	
B-4-11	Cozcaquahtli Necklace Eagle	Tlatelolco	Land	Yes	-	-	-	-	
B-4-12	Oactli	Tlatelolco	Land	No	-	-	-	-	
B-4-13	Tzopilotl	Tlatelolco	Land	Yes	-	-	Not Eaten (Tenoch: SIST)	-	

Code Number for Aztec Text	Aztec Bird Name English literal translation or Onomatopoeic origin	Origin of Aztec Language Account	Foraging Habitat	Physical Description in Aztec Text	Abundance Data	Water folk and their cultural beliefs about birds mentioned	Eaten or Not-eaten by Humans	Spanish Bird Names in Aztec Texts	Comments
B-4-14	Tecolotl (Onomatopoeic name)	Tlatelolco	Land	Yes	-	-	-	-	
B-4-15	Çacatecolutl Grass Owl	Tlatelolco	Land	Yes	-	-	-	-	
B-4-16	Cacalotl "Tongs or Pincers"	Tlatelolco	Land	Yes	-	-	-	-	
B-4-17	Acacalotl Water "Tongs or Pincers"	Tlatelolco	Water	Yes	-	-	-	-	
B-4-18	Pipixcan (Text indicates connection with gathering or harvesting; <i>pixca</i>)	Tlatelolco	Water	Yes	-	-	-	Paloma (Color model)	
B-4-19	Tlhotli	Tlatelolco	Land	Yes	-	-	-	-	
B-4-20	Tlhoquauhtli Falcon Eagle	Tlatelolco	Land	Yes	-	-	-	-	
B-4-21	Quauhtlotli Eagle Falcon (or possibly Wood or Forest Falcon)	Tenochtitlan	Land	Yes	-	-	Not eaten (Tenoch: AT)	Alcon (Synonym)	
B-4-22	Coztlhotli Yellow Falcon	Tenochtitlan	Land	Yes	-	-	-	Turcuello (Synonym for male)	
B-4-23	Hecatlhotli Wind Falcon	Tenochtitlan	Land	Yes	-	-	-	Alcon (Model)	
B-4-24	Aiauhlhotli Mist or Fog Falcon	Tenochtitlan	Land	Yes	-	-	-	Moralo (Synonym) Alcon (Model)	
B-4-25	Iztac Tlhotli White Falcon	Tenochtitlan	Land	Yes	-	-	-	Sacre (Synonym)	
B-4-26	Itztlhotli Obsidian Falcon	Tenochtitlan	Land	Yes	-	-	-	Cavillan (Synonym)	
B-4-27	Itztlhotli Obsidian Falcon	Tlatelolco	Land	Yes	-	-	-	-	

Code Number for Aztec Text	Aztec Bird Name English literal translation or Onomatopoeic origin	Origin of Aztec Language Account	Foraging Habitat	Physical Description in Aztec Text	Abundance Data	Water folk and their cultural beliefs about birds mentioned	Eaten or Not-eaten by Humans	Spanish Bird Names in Aztec Texts	Comments
B-4-28	Iooalthotli Night Falcon	Tlatelolco	Land	No	-	-	-	-	
B-4-29	Necujictli	Tlatelolco	Land	Yes	-		Not Eaten (Tenoch: SIST)	-	
B-4-30	Têtzompa	Tlatelolco	Land	Yes	-	-	-	-	
B-5-1	Xochitototl Flower Bird	Tlatelolco	Land	Yes	-	-	-	-	
B-5-2	Aiacachtototl Rattle Bird	Tlatelolco	Land	Yes	-	-	-	-	
B-5-3	Tachitovia Onomatopoeic name	Tlatelolco	Land	Yes	-	-	-	-	
B-5-4	Quauhtotopotli Tree-pecker	Tlatelolco	Land	Yes	-	-	-	-	
B-5-5	Poxaquatl Fool (FC)	Tlatelolco	Land	Yes	-	-	-	-	
B-5-6	Vitalotl	Tlatelolco	Land	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-5-7	Chiquatli	Tlatelolco	Land	Yes	-	-	-	-	
B-5-8	Tapalcatzotzonqui Potsherd Striker (or Potsherd Rattler)	Tlatelolco	Land	No	-	-	-	-	
B-5-9	Chichtli	Tlatelolco	Land	No	-	-	-	-	
B-5-10	Tlalchiquatli Earth Owl	Tlatelolco	Land	Yes	-	-	-	-	
B-5-11	Ilamatototl Old Woman Bird	Tlatelolco	Land	Yes	-	-	-	-	
B-5-12	Tlatvicitli (Onomatopoeic name: "Hello, hello, now wake up [begin the day!"])	Tlatelolco	Land	Yes	-	-	-	-	
B-5-13	Chiquâtototl	Tlatelolco	Land	Yes	-	-	-	-	
B-5-14	Çacatlaliti	Tlatelolco	Land	Yes	-	-	-	-	

Code Number for Aztec Text	Aztec Bird Name English literal translation or Onomatopoeic origin	Origin of Aztec Language Account	Foraging Habitat	Physical Description in Aztec Text	Abundance Data	Water folk and their cultural beliefs about birds mentioned	Eaten or Not-eaten by Humans	Spanish Bird Names in Aztec Texts	Comments
B-5-15	Tlapaltotl Red Bird	Tlatelolco	Land	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-5-16	Chiltotopil Little Chili-red Bird	Tlatelolco	Land	No (AT) Yes (ST)	-	-	Not Eaten (Tlat: AT Tenoch: ST)	-	
B-5-17	Molotl	Tlatelolco	Land	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-5-18	Quachichil Chili-red Head	Tlatelolco	Land	Yes	-	-	-	-	
B-5-19	Nochtotl Tuna Cactus Bird (If <i>noch</i> refers to <i>nocheztli</i> , it could indicate a shade of red)	Tlatelolco	Land	Yes	-	-	-	-	
B-5-20	Cocotli Onomatopoeic	Tlatelolco	Land	Yes	-	-	-	-	
B-6-1	name Çolin	Tlatelolco	Land	Yes	-	-	Eaten (Tlat: AT Tenoch: ST)	-	Montezuma Quail (<i>Cyrtonyx montezumae</i>), possibly also other Odontophoridae.
B-6-2	Tecuçoli Lord (or Lordly?) Quail	Tlatelolco	Land	Yes	-	-	-	-	
B-6-3	Ooaton Small, young corn stalk	Tlatelolco	Land	Yes	-	-	-	-	
B-7-1	Tzanatl	Tlatelolco	Land	Yes	-	-	Not Eaten (Tenoch: SIST)	-	Male Slender-billed Grackle (<i>Quiscalus palustris</i>)
B-7-2	Teutzanatl (Teotzanatl) Marvelous (or Genuine or Divine or Precious, etc.) Grackle	Tlatelolco	Land	Yes	-	-	-	-	Male Great-tailed Grackle (<i>Quiscalus mexicanus</i>)

Code Number for Aztec Text	Aztec Bird Name English literal translation or Onomatopoeic origin	Origin of Aztec Language Account	Foraging Habitat	Physical Description in Aztec Text	Abundance Data	Water folk and their cultural beliefs about birds mentioned	Eaten or Not-eaten by Humans	Spanish Bird Names in Aztec Texts	Comments
B-7-3	Acatzanatl Reed Grackle	Tlatelolco	Land	Yes	"Many" (Tenoch: SIST)	-	Not Eaten (Tenoch: SIST)	-	Other plumages of Slender-billed Grackle
B-7-4	Coiohtotl Bell Bird (i.e. tinkling type of bell)	Tlatelolco	Land	Yes	-	-	-	-	
B-7-5	Vilotl Onomatopoeic name	Tlatelolco	Land	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-7-6	Tlacavilotl Daytime Dove or Person-Dove	Tlatelolco	Land	Yes	-	-	Eaten (Tenoch: SIST)	-	
B-8-1	Cujtlacochin Onomatopoeic name	Tlatelolco	Land	Yes	-	-	-	-	
B-8-2	Çentzontlatole "It has 400 words (or speeches, or songs, etc.)"	Tlatelolco	Land	Yes	-	-	-	-	
B-8-3	Miaoatotl Corn Tassel Bird	Tlatelolco	Land	Yes	-	-	-	-	
B-8-4	Chiqujmoli	Tenochtitlan	Land	Yes	-	-	-	-	
B-8-5	Chachalacametl (Onomatopoeic name). The Aztec verb <i>chachalaca</i> "To talk, talk loud, sing, etc." may be derived from this bird's song.	Tenochtitlan	Land	Yes	-	-	-	-	
B-9-1	Totoli	Tlatelolco	Land	Yes	-	-	Eaten (Tlat: AT Tenoch: ST)	-	Domestic Turkey (<i>Meleagris gallopavo</i>)

Code Number for Aztec Text	Aztec Bird Name English literal translation or Onomatopoeic origin	Origin of Aztec Language Account	Foraging Habitat	Physical Description in Aztec Text	Abundance Data	Water folk and their cultural beliefs about birds mentioned	Eaten or Not-eaten by Humans	Spanish Bird Names in Aztec Texts	Comments
C-1-4	Çoqujcanauhtli	Tlatelolco	Water	Yes	-	-	-		The Spanish text says that this bird has been mentioned in Chapter 2, but I could not find it there.
C-1-7	Atapalcatl	Tlatelolco	Water	Yes	-	-	-		Replaced by <i>Atapalcatl</i> B-3-35 (Tenochtitlan) in Spanish Text.
C-1-8	Atoncuepotli	Tlatelolco	Water	Yes	-	-	-		Replaced by <i>Tolcomoctli</i> B-3-26 (Tenochtitlan) in Spanish Text
C-1-9	Ateponaztli	Tlatelolco	Water	Yes	-	-	-		Replaced by <i>Tolcomoctli</i> B-3-26 (Tenochtitlan) in Spanish Text

Table 2. Aztec language bird accounts from Book 11 of the *Florentine Codex* (Table 1). Classification was determined according to main foraging site (land or water) and city in which the account was first written. As can be seen, Tlatelolco contributed mostly land bird accounts while Tenochtitlan contributed mostly water bird accounts. The reasons for this difference are unknown and several plausible explanations exist.

City of Origin	Land Birds	Water Birds	Unknown	Total
Tlatelolco	80	26	2	108
Tenochtitlan	12	28	1	41
Total	92	54	3	149

originated from Tlatelolco (Table 1). In two of the latter accounts, the Spanish text supplies the missing physical description, indicating that this information originated from Tenochtitlan via the scholia from the peer review process there.

Bird abundance

Information about abundance is given in 17 of the 149 Aztec language bird accounts (Table 1). In each case, this information originated from Tenochtitlan, either in the Aztec accounts written in that city (15 cases) or in the Spanish texts of Aztec language accounts from Tlatelolco (2 cases) that were peer-reviewed and improved in Tenochtitlan (Table 1).

Of the 17 bird accounts with abundance data, all except two were water birds (Table 1). However, one of the two land birds with abundance data lived, at least partially, in wetlands (B-7-3 *Acatzanatl*, Slender-billed Grackle *Quiscalus palustris*, Haemig 2010).

Birds eaten or not eaten for food by humans

Fifty-two of the 149 bird accounts contain information about whether or not the bird described was eaten for food by humans (Table 1). In seven of these cases, the bird described was not eaten by humans.

Twenty-nine of the 41 bird accounts originating in Tenochtitlan contain information about whether or not the bird described was eaten by humans (Table 1). Twenty-three of the 108 bird accounts originating from Tlatelolco also contain such information, but in seventeen of these accounts the information is present only in the Spanish texts, indicating that these data were added later in Tenochtitlan (Table 1).

Tlatelolco reported only five birds eaten by humans: Wild Turkey (*Meleagris gallopavo*), Domestic Turkey, Montezuma Quail (*Cyrtonyx montezumae*), Sandhill Crane (*Grus canadensis*), Greater White-fronted Goose (*Anser albifrons*) (Table 1). Tenochtitlan confirmed that these birds were eaten and added 40 smaller birds to the list, including a diversity of ducks, shorebirds, gallinules, pigeons, doves and passerines (Table 1).

Medicinal uses of birds

Three Aztec language bird accounts, all written in Tlatelolco, document the deliberate use of birds in attempting to heal or harm the health of people (*Vitzitzili* B-2-7, *Cocotli* B-5-20, *Totoli*

B-9-1). All three cases have warning phrases (see below) in the Aztec text. The second and third accounts also have warning phrases in the Spanish text (Table 4), but not the first account. Thus, only the medicinal information in *Vitzitzili* (B-2-7) was regarded by the research group as factual.

Use of Spanish bird names in the Aztec language bird accounts

Only one of the 108 Aztec language accounts from Tlatelolco contains a Spanish bird name (*paloma*). In contrast, eight Spanish bird names (*paloma*, *halcón*, *capón*, *gavilán*, *moralo*, *pato*, *sacre*, *turcuello*) are found in twelve of the 41 Aztec language bird accounts from Tenochtitlan (Table 1). Thus, while Spanish bird names are absent from the majority of Aztec language bird accounts of both cities, they are more frequent in the accounts from Tenochtitlan (Fisher's Exact Test, Two-tailed, $p < 0.0001$).

The Spanish bird names are used three ways in the Aztec language texts: (1) as synonyms for Aztec bird names; e.g. Spanish *sacre* for *Iztac Tlhotli* (B-4-25, Prairie Falcon *Falco mexicanus*), (2) as vernacular names for old world birds introduced into México; e.g. *capón* (*Tolcomoctli*, B-3-26), and (3) as color and size models used to describe the birds in the Aztec language accounts, e.g. "white like a *paloma*" (*Pipixcan*, B-4-18), "the same size as the Castilian *Totolin* [= Castilian "turkey", i.e. chicken], the *capón*" (*Tolcomoctli*, B-3-26). Five of the eight Spanish bird names used in the Aztec language accounts are raptors (Table 1).

References to Water Folk (*Atlaca*)

Although both cities contributed almost equal numbers of water bird accounts (Table 2), six of the 28 Aztec language accounts from Tenochtitlan mentioned water folk (*Atlaca*) and their cultural beliefs about birds, while zero of the 26 from Tlatelolco did (Table 1). This difference was statistically significant (Fisher's Exact Test, Two-tailed, $p = 0.0235$).

Discussion

Sahagún wrote that his research group described "the better known and most utilized...birds" of New Spain (Sahagún [1577] 1982, p.87). When examining their work, it is important to remember this statement because it explains why the bird chapter focuses so much on applied ornithology and ethno-

ornithology. It also explains why, while most birds with abundance data are reported to be numerous, a few rare birds also appear in the bird chapter. In all but one case, the rare birds were well-known to the Aztecs as omens or were believed to possess special magical powers (Table 1, Table 4).

The present study has discovered important differences in the contributions of the two cities to the *Florentine Codex's* bird chapter. The most important difference is that the bird accounts from Tlatelolco were mainly land birds, while those from Tenochtitlan were mainly water birds.

Tlatelolco produced over twice as many bird accounts as Tenochtitlan and supplied the only information on medicinal uses of birds. The latter result is not surprising because Tlatelolco also produced the *Códice de la Cruz-Badiano* or *Libellus de medicinalibus indorum herbis* (Cruz 1964, Kumate 1992, León-Portilla 1994), which contains additional examples of the use of birds in Aztec medicine (reviewed by Corona-Martínez 2002).

However, while the *Tenochca* (people of Tenochtitlan) peer-reviewed the work of the *Tlatelolca* (people of Tlatelolco), there is no evidence that the *Tlatelolca* peer-reviewed the work of the *Tenochca*. This explains why the Spanish and Aztec texts of the bird accounts from Tlatelolco usually differ more from each other than the Spanish and Aztec texts from Tenochtitlan differ from each other.

Tenochtitlan contributed all information on the abundance of various birds and most of the information on which birds were eaten and not eaten by humans. However, both cities supplied physical descriptions of birds for most (Tlatelolco) or all (Tenochtitlan) of the accounts they produced.

Spanish bird names in the Aztec texts

Why were Spanish bird names used more frequently in the Aztec language bird accounts from Tenochtitlan than in those from Tlatelolco? One possible answer is that the Aztecs from Tenochtitlan had more close and frequent contact with Spanish speakers than did the Aztecs from Tlatelolco. According to Lockhart (1992, p. 261-262),

Linguistic phenomena prove to be the most sensitive indicator the historical record contains of the extent, nature and trajectory of contact between the two populations [Spanish and Nahuatl]...The theory that the rate of linguistic change in Nahuatl is a function of the amount of contact between the two populations involved automatically predicts that the change will come first where the largest number of Spaniards and Nahuas had daily encounters and subsequently spread out to the rest of the Nahuatl-speaking community.

Did the Nahuas of Tenochtitlan have more frequent and intense contact with Spaniards than the Nahuas of Tlatelolco during the sixteenth century? Yes, in 1522, when Emperor Cuauhtémoc surrendered the Aztec empire to the Spanish, Cortés decided to build the Spanish colonial capital on the ruins of Tenochtitlan (Gibson 1964, Mundy 2015, Rodríguez-Alegría 2017). Subsequently, the Spanish marked off a large section (26 blocks by 26 blocks) in the center of Tenochtitlan for white settlement (Gibson 1964, Mundy 2015). This section, the *traza*, also became the official residence of the governor of New Spain, the viceroy and the *real audiencia* [royal court]. Gibson (1964, p. 37) writes:

Tenochtitlan...was unique among colonial Indian communities of the Valley [of México] in that a large section of its center was marked off to house the Spanish colonists. Moreover, it was the only Valley location to maintain a *cabildo*, or municipal council, of Spaniards. But its four barrios – under their colonial names Santa María [Cuepopan], San Sebastián [Atzacolco], San Pablo [Teopan], and San Juan [Moyotlan] – remained as sites of Indian habitation.

Thus, in comparison to Tlatelolco, Tenochtitlan had large populations of both Spanish-speakers and Aztec-speakers. Consequently, there may have been more opportunities for Hispanic loan words, such as Spanish bird names, to enter the Aztec language in Tenochtitlan than in Tlatelolco.

The fact that many Spanish bird names found in the Aztec language bird accounts from Tenochtitlan are for birds-of-prey (Table 1, Table 3) could indicate that the *Tenochca* had contact with Spanish colonists who practiced falconry. The Spanish text adds credence to this idea by noting that the Spaniards believed that the falcons and hawks of México were “better than those of Spain” (Sahagún [1577] 1988, p. 707). Here we must ask, (1) “Who were the Spaniards mentioned and in what ways did they believe that Mexican raptors were better?” and, (2) “How did these Spaniards obtain a good enough knowledge of birds-of-prey in both Spain and México to be able to judge which region’s raptors were better?” Spanish colonists who practiced falconry provide a good answer for both of these questions, as well as a reasonable explanation for the numerous Spanish raptor names in the Aztec language bird accounts from Tenochtitlan.

Another indication in the bird chapter of increased contact between Aztecs and Spaniards in Tenochtitlan was the use of waterfowl quill feathers for writing, a European custom unknown to the Aztecs before contact with Spaniards (Sahagún [1577] 1961, Boone 2008, Diel 2012). The original account from Tlatelolco of the *Tlalalacatl* (B-3-5, Greater White-fronted Goose *Anser albifrons*) simply stated that this goose’s down

Table 3. Hypothesized identity of some of the peer-reviewers and collaborators in Tenochtitlan, based on content analysis of the bird accounts in Chapter 2, Book 11 of the *Florentine Codex*.

Persons	Supporting Evidence and Other Relevant Facts
One or more of the water folk <i>Atlaca</i> , who made their living by hunting and fishing in the wetlands surrounding Tenochtitlan.	<ol style="list-style-type: none"> 1. Most bird accounts from Tenochtitlan are about water birds (Tables 1 & 2). These accounts describe a great diversity of waterfowl, including wintering migrants (Table 1). 2. Water folk are specifically mentioned in bird accounts from Tenochtitlan, but not those from Tlatelolco (Table 1). 3. Water folk cultural beliefs about birds (omens, sorcery, etc.) are mentioned only in the accounts and scholia from Tenochtitlan (Table 1). 4. Only bird accounts and scholia from Tenochtitlan contain information about the abundance of water birds, which the water folk knew about from experience (Table 1). 5. Information about which birds were eaten and which were not eaten was contributed mainly by Tenochtitlan (Table 1).
Someone familiar with birds in the Sierra de los Tuxtlas region.	<ol style="list-style-type: none"> 1. Two bird accounts from Tenochtitlan (<i>Pôpocales</i> B-2-20, <i>Tecuciltotol</i> B-2-21), mention specific localities (Toztlan, Catemahco) in the Sierra de las Tuxtlas region. See Venter (2012, 2017) for maps.
People who had knowledge of Mexican birds-of-prey, Aztec religious beliefs, and who also had contact with Spanish falconers.	<ol style="list-style-type: none"> 1. Many different raptors, both tame and wild, were sold in the markets of pre-Hispanic Mexico (López de Gómara in Schroeder et al. 2010, p. 206). 2. Some Aztecs in pre-Hispanic Mexico, including Aztec Emperor Montezuma II, practiced falconry (López de Gómara in Schroeder et al. 2010, pp. 206, 216-217). 3. Many Aztec language bird-of-prey accounts in the <i>Florentine Codex</i> were written in Tenochtitlan (Table 1). 4. The peer reviewers in Tenochtitlan found two raptor accounts from Tlatelolco to be unsatisfactory and so wrote two new accounts to replace them (Table 1). Consequently, in the Spanish text, the Tlatelolco accounts were omitted, and only the new accounts from Tenochtitlan were translated. 5. In the account of <i>Quauhtlotli</i> B-4-21 from Tenochtitlan, reference is made to Aztec religious beliefs about falcons. 6. Spanish names for birds-of-prey appear in the Aztec language bird accounts from Tenochtitlan, but not in the Aztec language bird accounts from Tlatelolco (Table 1).

feathers were used to make *Tilmatlí*, an indigenous cloak, cape or mantle (Appendix G). The *Tenochca* confirmed this use in their peer review and then, via the scholia later inserted into the Spanish text, added, “The feathers above [the down] are strong. They have good quills for writing.” The fact that quill pens for writing were mentioned in the Tenochtitlan text, but not in the Tlatelolco text, suggests that they were used more

often in Tenochtitlan, which would not be surprising since, as we have seen, there were more Spaniards in Tenochtitlan.

The lone Spanish bird name from Tlatelolco, *paloma* (Table 1), refers specifically to the white color phase of this bird, and is used as a color model to describe a gull (*Pipixcan* B-4-18): “It is white, like a paloma” (Sahagún [1577] 1963, p. 43). For millennia, the *paloma blanca* (white dove) has been used by

Christians as a symbol of the Holy Spirit and Her works (love, joy, peace, hope, fortitude, divine guidance, inspiration, and others; see Barnes 1909). In sixteenth-century México, Roman Catholic clergy were often the first Spaniards to learn the Aztec language and have close, personal contact with the Indians (Motolinia [1541] 1979, Mendieta [1596] 1980). In addition, many Aztecs attended church worship services, pageants and social activities (Burkhart 2017). If, by the time Sahagún's research group worked, the *paloma blanca* was illustrated in stained-glass windows, paintings or other ecclesiastical art seen by the *Tlatelolca*, or if feral pigeons *Columba livia* had been introduced into México City by then, or if the white color phase of these birds was being used at that time as release doves at weddings and other church ceremonies, we would have reasonable explanations for why *paloma* seems to have been the first Spanish bird name used by the *Tlatelolca* (Table 1).

Bird data not accepted by Sahagún's research group

The research group did not believe all bird information they were told (Table 4). Claims which they did not accept fall mainly into two categories: (1) Indigenous folklore (fables, omens, portents, transmutations) and native religious beliefs, and (2) Information from geographically remote localities that the research group could not verify, such as a claim that a certain bird nested there. Some claims in the second category might actually be correct, so the research group's methodology can best be characterized as cautious, conservative and skeptical.

Tenochca peer reviewers and collaborators

The Aztecs from Tenochtitlan were both peer-reviewers and collaborators. They scrutinized and amended the bird accounts from Tlatelolco, but also collaborated with Sahagún's research group to add completely new bird accounts to the manuscript (Table 1, Table 2).

Although the names of these *Tenochca* have been lost, we can make some intelligent guesses about who some of them were by analyzing the information they provided the research group either in person or in pictorial manuscripts (Table 3). For example, the focus of the Tenochtitlan accounts on water birds, edible bird species, avian abundance, and their many references to the water folk (*Atlaca*), all suggest that the research group collaborated with one or more persons from the *Atlaca* while working in Tenochtitlan (Table 1, Table 3).

A prehistoric lacustrine culture, the *Atlaca* made their

living by hunting birds, collecting eggs and harvesting other aquatic biota such as fish, frogs, salamanders, turtles, insects, crustaceans, mollusks, aquatic flowering plants and algae in the then extensive and highly productive wetlands of the Valley of México (Linné 1937, 1940, Parsons 2005, 2006, De Lucia 2013, Millhauser 2017; see also Albores 1995; Sugiura 1998, 2000, Williams 2014). It would therefore have been natural and logical for Sahagún's research group to seek information about birds from the *Atlaca*.

Other individual water folk could have also assisted the research group in Tlatelolco, for many water bird accounts were written there too (Table 2). However it is in the Tenochtitlan bird accounts and scholia that one especially feels the presence and influence of the *Atlaca*. For there the water folk and their cultural beliefs about birds are specifically mentioned, something completely absent from the Aztec language bird accounts written in Tlatelolco (Table 1).

Two bird accounts (*Pôpocales* B-2-20, *Tecuciltotol* B-2-21) from Tenochtitlan mention occurrence at Toztlan and Catemahco, in the Sierra de los Tuxtlas region of present-day Veracruz state (see maps in Venter 2012, 2017). The specific mention of these localities suggests that at least one of the collaborators in Tenochtitlan was familiar with birds of the Tuxtlas region (Table 3).

The birth of Mexican ornithology

Sahagún's research group wrote the first known scholarly descriptions of Mexican birds (Table 1), the first known regional avifaunal work of Mexican birds (Table 1), and were the first scholars to formally and comprehensively distinguish fact from fable in the indigenous bird knowledge of México (Table 4). Because such bird research is now called ornithology (Stresemann 1975, Walters 2003, Chansigaud 2009), I believe that we are fully justified in calling the bird chapter of the *Florentine Codex* an early ornithological work.

Two additional lines of evidence also support designation of the work of Sahagún's research group as ornithology. The first of these is the fact that the majority of their bird accounts, *i.e.* those originating in Tlatelolco, were later peer reviewed in Tenochtitlan. Peer review is now a routine and essential part of all modern scientific research, including ornithology (Sahagún [1577] 1982, Haemig 2014, Berggren 2016).

The second additional line of evidence is the fact that numerous scholarly histories of ornithology report that ornithology began with Aristotle (Stresemann 1975, Walters 2003, Chansigaud 2009). Because Sahagún's research group pro-

duced a comparable or better work on birds than Aristotle, it would be wrong and unfair not to recognize their work as ornithology as well.

Escalante *et al.* (1993) and Navarro (1994) wrote that ornithology in México may have begun well before the Spanish conquest, because there were Mexicans then who were very knowledgeable about birds. I agree, and the results of my own research also point in that direction (Haemig 1978, 2010, 2011, 2012, 2014). It is even possible that in pre-Hispanic times there could have been an ornithological literature of sorts, consisting of painted, pictorial manuscripts (screenfolds) about birds (Appendix H). However, if such pictorial manuscripts of Mexican birds were ever made, none are known to be extant today, and there is currently not enough evidence to determine whether or not Mexican ornithology began in the pre-Hispanic era (see discussion in Corona-Martínez 2002).

We therefore have a situation in México similar to that of Europe. In Europe, Aristotle is recognized as the first ornithologist because his writings are the earliest-known, clear example of ornithological work (Stresemann 1975, Walters 2003, Chansigaud 2009). However, most researchers realize that there could have been, and probably were, Europeans before Aristotle who also studied birds. Nevertheless, because adequate documentation of their work has not survived, Aristotle is by default recognized as the first ornithologist.

Applying these same principles to México, I conclude that the scholars of Sahagún's research group should be recognized as Mexico's earliest-known ornithologists, because I can find no adequate documentation of any other scholars doing ornithological research in México before them. Yet, and this is an important implication of my conclusion, recognition of Sahagún's research group as México's first ornithologists is also recognition of the Aztecs who collaborated with them in Tlaxcala and Tenochtitlan, including the *Atlaca*, and also recognition of the sources from the pre-Hispanic past that contributed bird knowledge to the *Florentine Codex*.

Closing Remarks

There is a long history of the development of science, a scholarly evolution covering hundreds of years. Sahagún's research group is located at a much earlier point on this timeline than we are today and, consequently, we sometimes lack adequate vocabulary to describe their work in a precise way that satisfies everyone. In this paper, I have chosen to use well-known, established terms to describe their work, rather than invent new terms that are laborious and impractical for readers to learn

and use, especially those who do not have English as their native language. The latter often complain that there are already too many new scientific terms being invented every year in English for them to keep up with and assimilate (personal comments from fellow Swedish researchers).

What is important for all to realize is that "species descriptions", "regional avifaunal studies", "peer review", "group research", "science", "scholarly publication" and "ornithology" were not done in precisely the same way in sixteenth century México as today, because at that time our present ways of doing science and their associated technologies had not yet been invented. Nevertheless, it is appropriate, logical and practical to use such terms to describe the studies of Sahagún's research group, not only for the reason given above, but also because definitions of scientific terms often change and evolve through time anyway, over even much shorter periods than the 400-500 years separating us from the time of Sahagún's research group. For example, compare the definitions of terms "in the scientific literature, or the *Unabridged Oxford Dictionary of the English Language*, from several decades ago, to the meanings that we give to the same terms today" (Wilson 1995).

Sahagún's research group worked centuries before Linnaeus and Darwin, and so lacked the modern knowledge of birds, evolutionary concepts, research methods, specimen preservation technologies and museum collections that we have today to help us do our research. Furthermore, the Aztec folk taxonomy that they used does not always correspond to our current delineation of bird species and much of their formerly novel information has now been surpassed by more complete data from modern studies.

Because the *Florentine Codex* is ancient, sometimes difficult to understand, and appears to contain mistakes, it is tempting to simply give up trying to glean information from it and, with a superior sneer and flick of the hand, summarily dismiss it all as worthless. However, if we do this, we risk not only losing important data, but also of establishing and nourishing a tradition that, centuries into the future, could be used to unfairly denigrate and dismiss our own contributions to ornithology. For we today, like Sahagún's research group, do not use all the methods and technologies that future ornithologists will use hundreds of years from now.

Many other early ornithological writings, whose contributions we already acknowledge, suffer from the same defects as the *Florentine Codex*. For example, the great Linnaeus (1707-1778) sometimes made errors and wrote taxa descriptions that are today inadequate for diagnostic purposes. Linnaeus failed to recognize (1) the Red-throated Loon *Gavia stellata* as a species separate from the Arctic Loon *Gavia arctica*, (2) the Grey-

Table 4. Bird information not accepted as factual by Sahagun's research group. The group alerted readers to these unverified claims by prefacing them with warning phrases (Haemig 2012). In this way, Sahagun's group distanced themselves from outlandish claims and attempted to separate fact from fiction in their work. Abbreviations: A = Indigenous folklore (fables, omens, portents, transmutations) and religious beliefs.; B = Ornithological information from geographically remote localities that could not be verified, C = Opinion.

Bird Information not accepted by Sahagun's Research Group	Bird Accounts (Table 1) with the unaccepted information and their Spanish text warning phrases (Sahagun [1577] 1979)	Type of Info
These bird species are leaders of the water birds.	<i>Tlahquechol</i> (B-1-3): "Dicen que... [They say that...]" <i>Atotolin</i> (B-3-20): "...dicen que... [They say that...]"	A
Lovely Cotina (<i>Cotinga amabilis</i>) feathers can lose their blue color with careless handling (See Appendix I).	<i>Xiuhtotol</i> (B-1-9): "...dicen... [they say...]"	B
When people die their souls turn into these birds.	<i>Yollototol</i> (B-2-19): "...dicen que...[...they say that...]"	A
These birds transform themselves into fish and vice versa. This claim constitutes not only transmutation of species but also transmutation of vertebrate classes!	<i>Atzitzicujlotl</i> (B-3-14): "Dicen que... [They say that...]"	A
This bird nests in Anahuac.	<i>Atzitzicujlotl</i> (B-3-14): "Dicen que... [They say that...]"	B
These birds are "the heart of the water."	<i>Atotolin</i> (B-3-20): "Dicen que... [They say that...]" <i>Acoiotl</i> (B-3-21): "Toda la fabula que se dice del <i>atotoli</i> de arriba se dice tambien deste <i>acóyotl</i> . [Everything in the above fable that they say about the <i>Atotolin</i> they also say about this <i>Acoiotl</i> .]"	A
When humans kill or try to kill these birds, the birds use sorcery to summon the wind, sink canoes and drown people, or else they cause the death of Aztec lords.	<i>Quapetlaoac</i> B-3-24). "Tenían desto experiencia...que...[They had this experience...that...]" <i>Atotolin</i> (B-3-20): "Dicen que... [They say that...]" <i>Acoiotl</i> (B-3-21): "Toda la fabula que se dice del <i>atotoli</i> de arriba se dice tambien deste <i>acóyotl</i> . [Everything in the above fable that they say about the <i>Atotolin</i> they also say about this <i>Acoiotl</i> .]"	A
Certain birds function as omens and portents, revealing unanticipated events that will happen in the future.	<i>Tenitztli</i> (B-3-23): "Tienen por agüero...[They interpreted as an omen...]" <i>Quapetlaoac</i> (B-3-24) "Dicen cuando...[They said when...]" <i>Quatezcatl</i> (B-3-25): "Tenían por mal agüero...Decían que...[They interpreted as a bad omen...They said that...]" <i>Tolcomoctli</i> (B-3-26): "...toman conjetura...dicen que...[They conjecture...they say that...]" <i>Atapalcatl</i> (B-3-35): "...entienden que...[...they understand that...]" <i>Oactli</i> (B-4-12): "...que toman a las veces buen agüero y a las veces malo [...that they interpret sometimes as a good omen and sometimes bad.]" <i>Chiqujmoli</i> (B-8-4): "Dicen que... [They say that...]"	A
Raptors of Mexico are better than those of Spain.	<i>Itztllhotli</i> (B-4-26): "...dicen...que...[...they say...that...]"	C

Bird Information not accepted by Sahagun's Research Group	Bird Accounts (Table 1) with the unaccepted information and their Spanish text warning phrases (Sahagun [1577] 1979)	Type of Info
This raptor does not drink water.	<i>Necujictli</i> (B-4-29): "Dicen que...[They say that...]"	A
Grey Partridges (<i>Perdix perdix</i>) in Spain use the same distraction display as this quail.	<i>Ooaton</i> (B-6-3): "Dicen que... [They say that...]"	B
The Plain Chachalaca (<i>Ortalis vetula</i>) calls in order to awaken people.	<i>Chachalacametl</i> (B-8-5): "Dicen que... [They say that...]"	A
Fable of the falcon (See Appendix J).	<i>Quauhtlotli</i> B-4-21): Fable not present in Spanish text, warning phrase present in Aztec text.	A
Fable of the dove (See Appendix J).	<i>Viotl</i> (B-7-5): Fable not present in Spanish text, warning phrase present in Aztec text.	A

headed Woodpecker *Picus canus* as a species separate from the Green Woodpecker *Picus viridus*, and (3) the Little Ringed Plover *Charadrius dubius* as a species distinct from the Common Ringed Plover *Charadrius hiaticula* (Ericson and Tyrberg 2004).

In addition, Linnaeus confused the Peregrine Falcon *Falco peregrinus*, Gyrfalcon *Falco rusticolus* and Goshawk *Accipiter gentilis* and, consequently, it was not until a decade after his death that the Peregrine Falcon finally became clearly recognized as a separate species in Sweden (previously unpublished data from P.G. Lindroth and P. Osbeck in Ericson and Tyrberg 2004). Yet, fortunately, these and other shortcomings of Linnaeus' works have not prevented us from appreciating his many important and truly great contributions to ornithology (Stresemann 1975, Walters 2003, Chansigaud 2009).

In the same way, I believe that we can recognize and value the contributions of Sahagún's research group to Mexican ornithology without having to accept the mistakes they made or even understand completely the species concepts that the Aztecs used. Sahagún's group was the first to write scholarly descriptions of Mexican birds and the first to write a regional avifauna work on Mexican birds. In doing so, they contributed significant new information to science.

It is not easy to be the first to do something. One has no results from earlier researchers to compare with ones own, and no body of published knowledge upon which to build and improve. What seems so clear and easy for us today, over 400 years later, was not so in sixteenth-century México.

At that early stage of ornithology, with so many of the world's birds still unknown to science, ornithology was by necessity descriptive, involving primarily the accumulation of

basic knowledge about birds and the separation of fact from fable (Table 4). Sahagún's research group participated in this great work by combining the then established and accepted Aristotelian method of gathering factual information from knowledgeable persons and dependable manuscripts, with newer research methods that included the use of formalized questionnaires and peer review (López Austin 1974, Haemig 2012, 2014). The research group took the bird knowledge of the Aztec people and, separating away the fables, myths and unverifiable information (Table 4) from the facts, produced an authentic regional avifaunal work about "the better known and most utilized...birds" of México.

Some might argue that Sahagún's research group does not deserve our praise or recognition today because almost every ornithologist who has written a regional work on Mexican birds after them has done a better job. To such critics I would ask, "Isn't that the way science is supposed to function?" Sahagún's research group finished their fieldwork and completed the Aztec language texts and scholia for the *Florentine Codex* in 1569. Therefore, any ornithological work done by subsequent researchers after that date is supposed to be better. If later research is not better, or if it does not otherwise contain significant new information or insights, then it is not supposed to be published. Sahagún's group finished their work first, so we cannot reasonably require their manuscripts to be better than those who came after them. At the time of their completion, the manuscripts of Sahagún's group contained significant new information about the birds of México that had never been published before (e.g. Haemig 1978, 2010, 2011, 2012, 2014). Consequently, despite flaws, they were important contributions to ornithology.

And there is not only novel information in their manuscripts. There is also beauty. The research group's concise, succinct accounts are often quite eloquent, especially in the Aztec language in which they were originally written. Consider, for example, *Pipitzli* (B-3-45), written in Tenochtitlan in 1569:

It also lives in the water. Its head is black; its eyes are also black; white [feathers] are set on the eyelids [so that these] appear to be its eyes. It is somewhat long-necked. The throat and breast are white. Down the back of its neck, on its back, its tail, wings, wing tips, it is black. The tips of both wing-bends are white. Its legs are quite long, chili-red, slender. There is really not very much to its body, but it is quite tall. Some migrate, some remain and rear their young here. Four are its eggs; only on the ground, on dried mud, on the plain, or somewhere on the top of a clod it lays its eggs; not on grass nor feathers. It is edible. (Sahagún [1577] 1963, p. 39).

This appears to be a description of the Black-necked Stilt (*Himantopus mexicanus*, perhaps the earliest ever written for this species. And it is quite good. Even the ground nesting habit, number of eggs, and the bird's dual status as a breeding resident and migrant are accurate.

However, one significant error is that the tail should be "pale gray" not black (Ridgway 1919, p. 442). What could have caused this mistake? An imperfect translation? A melanistic or soiled specimen? An error in reading an image from a pictorial manuscript? Or were the long wings of this bird, which when folded at rest have overlapping tips that extend beyond the tail and cover it from above, mistaken as a black, forked tail when viewed from a distance. Such an error would be understandable when one remembers that, in the sixteenth century, binoculars had not yet been invented and the more secure method of writing bird descriptions based upon specimens in hand had not yet become the norm in ornithology.

It may not even have been possible for the research group to obtain a specimen of *Pipitzli* to examine in hand because of legal questions regarding property and collection rights. According to Millhauser (2017, pp. 310-311), "Sixteenth-century documents record individual and community ownership of territory dedicated to bird-hunting, fishing, and algae-collecting – as well as prolonged and bitter disputes over them (Gibson 1964:339-342, Hernández 1959:408-409)." Another hypothesis is that the text of the *Pipitzli* account is completely accurate but describes a different bird species, perhaps even one that no longer lives in the Valley of México (Appendix L).

Whatever the reasons for this apparent mistake, the *Pipitzli* account is still more detailed, informative and complete than the formal scientific description of the Black-necked Stilt published two centuries later by Müller (1776). Like many of the bird accounts from Tlatelolco and Tenochtitlan, it shows

clearly that Aztecs with substantial knowledge of birds helped to produce the *Florentine Codex*. The Renaissance-era studies of Sahagún's research group, on a now lost island in the formerly vast, bird-rich wetlands of the Valley of México, constitute the birth of Mexican ornithology and, coincidentally, give the history of Mexican ornithology a distinctive, Aztlán-like beginning, significantly different from the ornithological histories of neighboring countries.

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Appendix A

With the exception of Sahagún, the scholars of the research group were all native Mexicans. Their names (and birthplaces) were as follows: Antonio Valeriano (Azcapuzalco), Martín Jacobita (Tlatelolco), Alonso Vegerano (Quauhtitlan) and Pedro de San Buenaventura (Quauhtitlan). Each of these four scholars, as well as Sahagún himself, were fluent in three languages: Aztec, Spanish and Latin (see Sahagún [1577] 1982, pp. 54-55, Haemig 2012).

Appendix B

The names of the individual Aztecs who collaborated with the research group have been lost. However, the quality of the information that they provided (as seen in the bird accounts of the *Florentine Codex*) supports the view that they were persons with substantial knowledge about birds.

For a relevant comparison, there is one section of the *Florentine Codex* where the list of individuals that peer reviewed it has been preserved, and that list shows experts of the highest professional competence, suggesting that comparable experts (generalists or specialists) were chosen to review all other parts of the *Manuscript of Tlatelolco*, including the bird chapter. The list can be seen at the end of chapter 28 in Book 10, which describes Aztec medicines for curing various ailments and injuries. There, Sahagún's research group wrote the following note about the persons who peer-reviewed the original text from Tlatelolco, and the names of the *barrios* (neighborhoods) where they resided (Sahagún [1577] 1961, p. 163). It reads, "The above was examined [by] the Mexican physicians whose names follow:

Juan Pérez, of San Pablo [Teopan]

Pedro Pérez, of San Juan [Moyotlan]

Pedro Hernández, of San Juan [Moyotlan]

José Hernández of San Juan [Moyotlan]

Miguel Garcíá, of San Sebastián [Atzacolco]

Francisco de la Cruz, Xiuitonco [located in San Juan Moyotlan, see Caso 1956, pp.13-14]

Baltasar Juárez, of San Sebastián [Atzacolco]

Antonio Martínez, of San Juan [Moyotlan]"

As can be seen, all of these peer reviewers were physicians, so they must have been competent to judge the quality of information about medicine in the *Manuscript of Tlatelolco*. Furthermore, their homes are all listed as being in various *barrios* of Tenochtitlan: San Pablo Teopan, San Sebastián Atzacolco, San Juan Moyotlan, Xiuitonco (Caso 1956, Mundy 2015, p. 74, Schroeder 2016, p. 141), confirming Sahagún's statement that the *Manuscript of Tlatelolco* was peer-reviewed in Tenochtitlan (Sahagún 1577 [1982], p. 55).

Appendix C

In Haemig (2012), I correctly reported that Antonio Valeriano's wife, the Aztec princess Isabel Huanitzin, was a granddaughter of Aztec Emperor Montezuma II and was also closely related to many other Aztec emperors. However, between the time that I finished writing that paper and its acceptance for publica-

tion, Castañeda de la Paz (2011) published an important paper, which I did not see, in which she argued persuasively that Antonio Valeriano was also a member of the Aztec dynastic family by birth. According to Castañeda de la Paz, Valeriano's father was Francisco de Alvarado Matlacohuatzin, the son of Aztec Emperor Montezuma II's brother Tezozomoc Acolnahuacatl, who in turn was a son of Aztec Emperor Axayacatl, the brother of Emperor Auitzotl (also spelled Ahuítzotl). Valeriano's father was thus a nephew of Emperor Montezuma II. If Castañeda de la Paz (2011) is correct, then we must conclude that Antonio Valeriano was a member of the Aztec dynastic family by virtue of both birth and marriage.

Another consequence of Castañeda de la Paz's revelation is that the fathers of Antonio Valeriano and Isabel Huanitzin were brothers because they were both sons of Tezozomoc Acolnahuacatl. This means that Antonio Valeriano and Isabel Huanitzin were cousins. Marriage of such closely-related persons was common in the Aztec dynastic family and not considered to be wrong; see Carrasco (1984) for many other examples.

Appendix D

The three scribes (and their birthplaces) were Diego de Grado (Tlatelolco), Bonifacio Maximiliano (Tlatelolco), Mateo Serverino (Xochimilco) (Sahagún [1577] 1982, p. 55).

Appendix E

Palmeri Capesciotti (2001) used this method to show that three of the 149 bird accounts in Chapter 2 of the *Florentine Codex* show some resemblances to writings of Pliny the Elder and Bartholomaeus Anglicus. The three accounts are: *Quauhtli* B-4-1, *Itzquauhtli* B-4-8, and *Cocotli* B-5-20. The fact that these accounts show some resemblances to Pliny and Anglicus might indicate that the research group directly read translations of parts of those writings to their indigenous collaborators to inquire if they agreed with them.

In addition to the influences seen in the three bird accounts, the taxonomy, form, order and organization of Book 11 of the *Florentine Codex* has also been shown to resemble the works of classical European scholars such as Pliny, Aristotle, Bartholomaeus Anglicus and Isidoro de Sevilla (Palmeri Capesciotti 2001, Corona-Martínez 2002).

All of the above findings demonstrate the high competence of Sahagún's Research Group, for they reveal that the five trilingual scholars of the research group were very fami-

liar with the most important scholarly literature of their time, and that they sought to present the results of their investigations in forms, orders and categories that were already familiar to contemporary scholars. By doing so, the research group related their research to previously published work. We see similar writing today when regional works on birds are published: The taxonomy, form, order and organization resembles that established by earlier authors, researchers and taxonomists, and data from previously published studies are reviewed, making it easier for readers to find the information they seek and understand its relationship to already accepted knowledge (e.g. Berger 1972, Cramp *et al.* 1977-1996, AOU 1998).

Appendix F

Scholia containing glosses, critical comments, declarations, explanations of words and grammar, corrections, opinions, and new facts, including those from questionnaires and peer review in Tenochtitlan, were regarded as an integral part of the work being produced by Sahagún's research group. Thus, in the Prologue to Book One, Sahagún lamented the fact that it had not been possible, because of lack of funding, to place the scholia in the *Manuscript of 1569* (Sahagún [1577] 1982, pp. 46, 51, 55). Yet, it seems reasonable to assume that the scholia were complete by this time because he makes no further mention of them, unlike the Spanish translation which he later tells us was completed after Father Commissary General Fray Rodrigo de Sequera secured additional funding (Sahagún [1577] 1982, p. 56).

Originally, the research group intended to make three columns on every page of their twelve books, one for the Aztec text, one for a Spanish translation and one for the scholia (Sahagún [1577] 1982, p. 51). However, because of lack of funding, the group was not able to add either the Spanish translations or the scholia to the *Manuscript of 1569*, hence that manuscript contained only the complete Aztec texts (Sahagún [1577] 1982, pp. 46, 51, 56).

When the research group later produced the *Florentine Codex*, they wrote only two columns on every page. In the right column, they copied the Aztec language texts from the *Manuscript of 1569*. In the left column they placed illustrations and Spanish language texts that contained both the scholia and Spanish translations of selected parts of the Aztec language texts (Sahagún [1577] 1979, Dibble 1982, Haemig 2014). Thus, the results of the peer review in Tenochtitlan, which were originally intended to be in a third column, ended up inside the Spanish translation

in the left column. In the present paper, I assume that the Spanish translation of the Aztec text was perfect and that any additions to it originated via scholia from the peer review in Tenochtitlan.

Appendix G

The *tilmatli* (cloak, cape, mantle) was “an all-purpose garment worn by all classes of Aztec men. The *tilmatli* was the principal visual status marker in Aztec society, and its material, decoration, length and manner of wearing instantly revealed the class and rank of the wearer” (Anawalt 1981, pp. 27-33). In order to stay warm during the winter, the Aztecs covered themselves with *Tilmatli* woven of tiny feathers (Anawalt 1981). Down for making such *Tilmatli* came from at least three migratory waterfowl that were non-breeding visitors to the Valley of México (Table 1, final column).

Appendix H

For example, Diego Duran wrote that by 1486, the year Auitzotl (also spelled Ahuítzotl) became Aztec emperor, the Aztec state was so well organized that officials kept records of everything: “This nation had a special functionary for every activity, even minor ones. *Everything was so well recorded that no detail was left out of the accounts and registers*” [emphasis mine] (Duran [1581] 1994, p. 309).

Because Aztec introduction of the exotic Great-tailed Grackle (*Quiscalus mexicanus*) into the Valley of Mexico was the result of a specific command by Emperor Auitzotl, it may have been considered important enough to be documented in a pictorial manuscript (Sahagún [1577] 1979, Haemig 1978, 2011, 2014). Consistent with this view is the fact that the Aztec language text of the account from Tlatelolco (*Teotzantl* B-7-2), sounds very much like it was read directly from painted images on a pictorial manuscript. Also consistent is the presence in the same Aztec text of quoted words, suggesting association with a speech scroll on a pictorial manuscript that was based on eye-witness testimony (Haemig 2012, 2014). However, an equally plausible hypothesis is that the text was based solely on eye-witness testimony (Haemig 2012, 2014).

Appendix I

This claim is probably true. Blue coloration in birds is often caused by feather structure rather than pigments (Fox 1979,

p. 6), so it seems plausible that the blue colors of Lovely Cotinga feathers could be lost by careless handling during collection (see also Prum *et al.* 2012). In the Spanish text of the bird chapter of the *Florentine Codex*, this claim is prefaced by the warning phrase “dicen (they say)”. However, the same claim is not so prefaced when it is presented as fact in both the Aztec and Spanish texts of Book 9, Chapter 5 of the *Florentine Codex* (Sahagún [1577] 1959). This inconsistency can be explained by the fact that the two books were probably refereed by different Aztecs.

Appendix J

The final two fables in Table 4 are the only fables in the Aztec text of the bird chapter that are omitted from the Spanish language text of that chapter. The two omitted fables differ from all other information in the bird chapter in that they mention important persons in the pre-Hispanic Aztec religion. I therefore hypothesize that the research group omitted these two fables when writing the Spanish text because they feared censorship and persecution by the Inquisition, which had imposed a reign of terror on México during the 1570s when the Spanish text was completed.

The first fable, which is found in *Quauhtlotli* (B-4-21) mentions the god Uitzilopochtli (Huitzilopochtli), the most celebrated of all Aztec deities, whose religious cult involving intensive human sacrifice was the official state cult of the Aztec empire (Boone 1989). Starting in the sixteenth century, two different concepts of Uitzilopochtli arose among the Spanish. One saw him as something like a Graeco-Roman deity, the other as an incarnation of the devil (Boone 1989). The latter diabolical concept was obviously inspired by Uitzilopochtli's association with human sacrifice and war, and correlated well with the Spanish Conquistadors' descriptions of “the horrific idol in the blood soaked *Templo Mayor*” of Tenochtitlan (Boone 1989).

The second fable, which is found in *Viotl* (B-7-5) mentions an Aztec priest *tlamacazqui*. Although various elements of the Aztec religion are referred to in the Spanish texts of other parts of the *Florentine Codex*, Sahagún's research group may have realized that they lacked a convincing rationale (in the eyes of the Inquisitors) for mentioning an Aztec priest in a chapter about the better known and most utilized birds of New Spain.

I suggest, therefore, that by omitting these two fables in the Spanish language text, Sahagún's group hoped that their presence in the Aztec text would escape detection by the *Florentine*

Codex's intended readers: the King of Spain (Phillip II) and his advisors. Sahagún's group used illustrations to cover the empty spaces left in the Spanish text by the absence of these two fables (see Sahagún [1577] 1979). They later gave the completed *Florentine Codex* to their ally Father Commissary General Fray Rodrigo de Sequera to forward to the King (Dibble 1982). Sequera returned to Spain with it in 1580 (Dibble 1982).

Appendix K

One baffling aspect of the bird chapter in the *Florentine Codex* is the presence there of a mammal account (#B-3-27, *Acujtlachtli* [Water Bear]). Why wasn't this account placed in the mammal chapter? Perhaps the following facts and thoughts can help us understand this mystery: (1) The account of this mammal is not present in the *Manuscript of Tlatelolco* (Sahagún [1565] 1907). It was written in Tenochtitlan, the final city where Sahagún's research group did fieldwork. (2) Sahagún changed the order of the bird and mammal chapters, while working alone at the monastery of San Francisco de México before the Tenochtitlan fieldwork and peer review (Ballesteros-Gaibrois 1964, Palmeri Capesciotti 2001).

In the *Manuscript of Tlatelolco* (Sahagún [1565] 1907), the bird chapter (Chapter 16 = folios 248r-264r) was placed before the mammal chapter (Chapter 17 = folios 264r-275v). However, in Book Eleven of the *Florentine Codex*, the mammal chapter (#1) appears before the bird chapter (#2) (Sahagún [1577] 1979; Ballesteros-Gaibrois 1964). Presumably, the latter order was the same for the now lost *Manuscript of 1569*. Thus, one possible explanation for the mammal account appearing in the bird chapter is that the *Tenochca* composed it after they had finished the mammal chapter and were already working on the bird chapter.

At that time, it may not have been possible to go back and add the new mammal account to the mammal chapter, because space was no longer available there. Consequently, Sahagún's research group may have intended to move this lone mammal account to the mammal chapter when they made the next draft of their manuscript, but years later forgot to do so because of the long delay that occurred between the production of the *Manuscript of 1569* and the *Florentine Codex*. The public health crisis caused by the *matlazahuatl* epidemic (possibly typhus) in 1576, and its demographic consequences (Márquez Morfin and Storey 2017) could also have distracted Sahagún's group and interfered with their remembering to later move the account to the mammal chapter.

Appendix L

The hypothesis that some of the bird accounts in the *Florentine Codex* describe extinct birds seems highly speculative and unlikely. Nevertheless, whenever we make identifications of birds in the *Florentine Codex*, we must consider this hypothesis for two reasons: (1) the Valley of Mexico has suffered extreme environmental damage by humans during the past 450 years since Sahagún's research group worked there, and (2) one bird described in the *Florentine Codex*, the Slender-billed Grackle (*Quiscalus palustris*, *Tzanatl B-7-1*, *Acatzanatl B-7-3*), has not been seen by ornithologists for over one-hundred years and is now feared to be extinct (Peterson 1998, Haemig 2010). If ornithologists of the nineteenth and early twentieth centuries had not collected and described the Slender-billed Grackle, we would today be wondering which species Sahagún's research group was referring to when they wrote about this bird in the sixteenth century.



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