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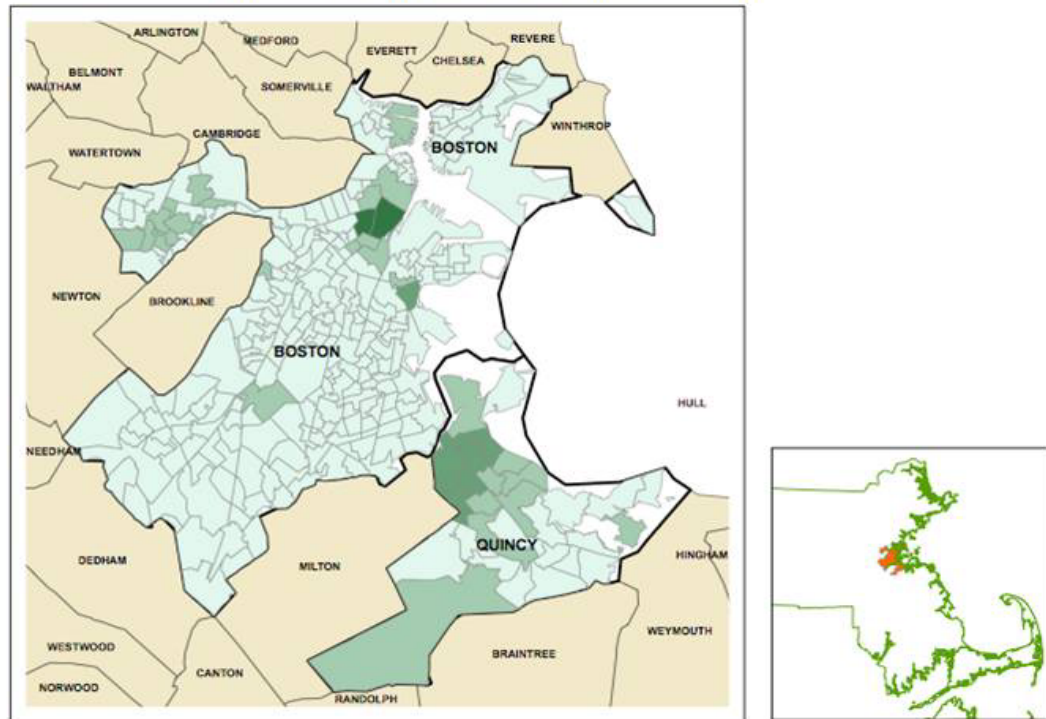
Estimate of Limited English Speaking Eligible Voters in Select Communities of the Boston Metropolitan Area

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Analysis and report produced by graduate students in the M.S. Geo-Information Science program
at Salem State College under the supervision of Dr. Marcos Luna
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Background

In 2005, the City of Boston reached a settlement agreement with the U.S. Department of Justice, which had sued the City over alleged voting rights violations. That agreement, which expired in December 2008, required Boston to provide bilingual transliterated ballots in Chinese and Vietnamese, as well as other measures. Boston started printing the ballots in areas with high numbers of Chinese and Vietnamese residents. However, without formal implementation of translation by the State Elections Committee, there is no assurance that translation will be continued in the future. The Coalition for Asian American Voting Rights has been spearheading the case to promote full translation of voting ballots. In order to make their case, they needed to know how many voters would need translated ballots by municipality and voting Precinct. Under the supervision of Dr. Marcos Luna, graduate students in the M.S. Geo-Information Science program at Salem State College offered to provide the needed numbers as a class project for an introductory course on Geographic Information Systems. This report is a summary of the analysis performed during the fall semester of 2008.

Objective

The analysis performed set out to determine the number and percentage of U.S. Citizens of voting age who speak a common language and do not speak English exclusively or very well by voting Precinct for the following municipalities:

- City of Boston
- Town of Brookline
- City of Cambridge
- City of Chelsea
- City of Lowell
- City of Malden
- City of Quincy
- City of Somerville

The specific languages of interest were:

- Chinese
- Haitian-Creole

- Khmer
- Portuguese
- Russian
- Spanish
- Vietnamese

The following sections describe the methods of analysis and potentials for error, followed by highlights of results organized alphabetically by municipality, summary tables with descriptive statistics, and then choropleth maps organized alphabetically by language. Appendices are found at the end of the report.

Methods

Data was compiled from the U.S. Census Bureau, Massachusetts Elections Division and MassGIS. The data were aggregated and analyzed to identify eligible voters who speak one of the languages of interest at home and speak English less than very well for select municipalities and their voting Precincts. These data were then mapped at both the Precinct and municipal scales using thresholds of 2%, 5%, and 10%.

Due to the unavailability of a data set with all necessary attributes for this study we had to estimate our target populations using related available data. We examined demographic information from three different tables in Census Summary Files 3 and 4 of the U.S. Census 2000, which was available by state, municipality and Census Tract, but not by voting Precinct. Refer to the Appendices at the end of the report for detailed explanations of calculation methods.

Apart from the fact that our data was already eight years old, the estimates are likely to have errors arising from certain assumptions that were unavoidable given the available data. The first assumption is that the characteristics of broad language groups are valid for the individual languages that comprise that group (e.g., both Khmer and Chinese share the same level of English language proficiency because they are both part of the “Asian-Pacific Islander” language group). The second assumption is that the municipal-wide ethnic/ancestry citizenship rates are the same for all Census Tracts within a municipality (e.g., rates of citizenship for Chinese speakers are the same across a municipality). The third assumption is that populations within Census Tracts are evenly spread out, which may not always be the case. The last assumption

was important because it enabled us to apportion data from Census Tracts to voting Precincts.

Census Tracts are small, relatively permanent statistical subdivisions of a county. The primary purpose of Census Tracts is to provide a stable set of geographic units for the presentation of decennial census data. Census Tracts generally have between 1,500 and 8,000 people, with an optimum size of 4,000 people. When first delineated, Census Tracts are designed to be homogeneous with respect to population characteristics, economic status, and living conditions. The spatial size of Census Tracts varies widely depending on the density of settlement. Census Tract boundaries are delineated with the intention of being maintained over many decades so that statistical comparisons can be made from decennial census to decennial census.

Voting Precincts are the smallest scale subdivisions of voting districts. Cities are divided first into Wards, and Wards are further subdivided into Precincts. Towns are divided into Precincts only. Based on the objectives of this analysis, we sought to determine numbers based on voting Precincts. However, Census data is enumerated by Census Tracts, not voting Precincts. In addition, Census Tracts and voting Precincts do not encompass the same exact areas. To resolve this discrepancy, we apportioned Census Tract data to voting Precincts based on their proportion of geographic overlap (see Appendix A).

Municipal-level calculations were based on statewide estimates of English language proficiency for each of the specific target languages, rather than relying on language groups as was necessary for Precinct-level calculations. Municipal-level calculations thus required fewer steps in the process of estimation, which decreases the probability for error. However, municipal-level calculations are based on the assumption that language proficiency rates for speakers of each of the target languages are the same throughout the Commonwealth (e.g. Chinese speakers in all municipalities have the same rate of English language proficiency). All references to municipal-level numbers derive from this second method (see Appendix B).

Results

City of Boston

According to the 2000 Census, there were approximately 37,000 eligible voters who spoke one of the languages of interest at home and spoke English less than very well in the City

of Boston. Just over half of these limited English speakers (50.9%) spoke Spanish at home. Most of these Spanish speakers were concentrated in the East Boston, Roxbury, Jamaica Plain, and Allston-Brighton neighborhoods. For Boston as a whole, Spanish speakers constituted approximately 4.9% of all eligible voters. However, in 24 voting Precincts, Spanish speakers made up more than 10% of all eligible voters, and in 82 voting Precincts they made up more than 5% of all eligible voters.

The next largest group of limited English speaking eligible voters were those who spoke Chinese at home. Chinese speakers made up just under 14% of limited English speaking voters evaluated. These voters were somewhat more dispersed, though higher than average numbers were found in the Chinatown, Central Boston, Charlestown, Allston-Brighton, and Roxbury neighborhoods. For Boston as a whole, Chinese speakers constituted approximately 1.3% of all eligible voters. Chinese speakers made up more than 10% of all eligible voters in 2 voting Precincts in Chinatown, and more than 5% of all eligible voters in 9 voting Precincts in the neighborhoods of Allston-Brighton and North Dorchester.

Haitian Creole speakers made up slightly less than 10% of the limited English speaking groups evaluated. These individuals were concentrated at the intersection of lower Roxbury, Mattapan and Roslindale. For Boston as a whole, Haitian Creole speakers made up slightly less than 1% of all eligible voters. These voters did not exceed 10% of all eligible voters in any Precinct. However, they did exceed 5% in 13 Precincts, most of which were in the Mattapan neighborhood.

Russian, Vietnamese and Portuguese speakers were about equal in number (approximately 3,000), and were tied for the fourth largest limited English speaking voting group. Each group was 8% of the limited English groups investigated. Russian speakers were largely concentrated in Allston-Brighton, spilling into the Back Bay and Kenmore neighborhoods. One Precinct in Roslindale also showed higher than average numbers of Russian speakers. Vietnamese speakers were concentrated in South Dorchester, with some spillover into the southern part of North Dorchester. Portuguese speakers were concentrated in Allston-Brighton, and straddling upper Roxbury and North Dorchester. For Boston as a whole, each

group was less than 1% of all eligible voters. Russian speakers exceeded 10% of all voters in 2 Precincts in Allston-Brighton. They exceeded 5% of all voters in 10 Precincts, 9 of which were in Allston-Brighton and 1 in the Fenway neighborhood. Vietnamese speakers exceeded 10% of all voters in 3 Precincts spanning North and South Dorchester. They exceeded 5% of all voters in 14 Precincts in the same neighborhoods. Portuguese speakers exceeded 10% of all voters in 3 Precincts spanning upper Roxbury and North Dorchester. They exceeded 5% of all voters in 12 Precincts in the same neighborhoods.

Khmer speakers were by far the smallest group evaluated. They comprised a fraction of 1% of the limited English speaking voters evaluated. Khmer speakers were spread thinly across the City. They were less than 2% of voters in all voting Precincts for Boston.

Town of Brookline

According to the 2000 Census, there were approximately 2,800 eligible voters who spoke one of the languages of interest at home and spoke English less than very well in the Town of Brookline. Approximately 40% of these spoke Russian at home. Russian speakers were largely dispersed in Brookline, although there was a slight concentration on the Allston-Brighton border. For Brookline as a whole, Russian speakers constituted approximately 2.8% of all eligible voters. Russian speakers exceeded 2% of all eligible voters in only one of the Town's voting Precincts, but did not exceed 5% in any Precinct..

The next largest group of limited English speaking eligible voters were those who spoke Chinese at home. Chinese speakers made up approximately 32% of limited English speaking voters evaluated. These voters were concentrated in pockets of the Town's southwest and northeast. For Brookline as a whole, Chinese speakers constituted approximately 2.3% of all eligible voters. Chinese speakers made up more than 2% of all eligible voters in 6 voting Precincts, but did not exceed 5% in any Precinct..

Spanish speakers made up approximately 21% of limited English speaking eligible voters. These eligible voters were spread fairly evenly across Brookline. Spanish speakers did

not exceed 2% of all eligible voters in any voting Precinct.

Portuguese, Haitian Creole, Vietnamese and Khmer speakers each constituted less than 1% all eligible voters for Brookline. These eligible voters were spread fairly evenly across the Town. None exceeded 2% of all eligible voters in any voting Precinct.

City of Cambridge

According to the 2000 Census, there were approximately 4,800 eligible voters who spoke one of the languages of interest at home and spoke English less than very well in the City of Cambridge. Approximately 38% of these spoke Spanish at home. Spanish speakers were largely dispersed in the City. For Cambridge as a whole, Spanish speakers constituted approximately 2.6% of all eligible voters. Spanish speakers exceeded 2% of all eligible voters in 14 voting Precincts, primarily in the southeastern part of Cambridge and in a pocket in the northwest. They exceeded 5% of all eligible voters in 1 Precinct in the southeast, but did not exceed 10% in any Precinct.

The next largest group was Chinese speakers, representing approximately 25% of the eligible voters of interest. Chinese speakers were concentrated in the extreme southeastern and northwestern parts of the City. For Cambridge as a whole, Chinese speakers constituted approximately 1.7% of all eligible voters. Chinese speakers exceeded 2% of all eligible voters in 6 voting Precincts in the southeastern and northwestern edges of Cambridge, but did not exceed 5% in any Precinct.

Portuguese speakers represented approximately 15% of the eligible voters of interest. Portuguese speakers were concentrated in the eastern portion of the City, mostly near the border with Somerville. For Cambridge as a whole, Portuguese speakers constituted approximately 1% of all eligible voters. Portuguese speakers exceeded 2% of all eligible voters in 5 voting Precincts, 5% of all eligible voters in 4 voting Precincts, and 10% of all eligible voters in 1 voting Precinct. All of these were found along the Somerville border.

Haitian Creole, Russian, Vietnamese and Khmer speakers each constituted less than 1% of Cambridge's total eligible voters. Haitian Creole speakers exceeded 2% of all eligible voters in 3 voting Precincts and 5% of all eligible in 1 voting Precinct, but did not exceed 10% in any Precinct. Haitian Creole speakers were concentrated first in the northwestern part of the City and also in the southeast. None of the other language groups exceeded 2% of eligible voters in any Precinct.

City of Chelsea

According to the 2000 Census, there were approximately 4,000 eligible voters who spoke one of the languages of interest at home and spoke English less than very well in the City of Chelsea. The vast majority, approximately 88%, spoke Spanish at home. Spanish speakers were heavily represented across Chelsea, though the highest concentrations were in the southern half of the City. For Chelsea as a whole, Spanish speakers constituted approximately 21% of all eligible voters. Spanish speakers exceeded 10% of all eligible voters in 7 voting Precincts. They exceeded 5% of all eligible voters in all 10 of Chelsea's voting Precincts.

Vietnamese and Portuguese speakers each represented just under 5% of the eligible voters of interest. Vietnamese speakers were largely concentrated in the southeastern portion of the Chelsea. Portuguese speakers were fairly evenly dispersed across the City. For Chelsea as a whole, Vietnamese and Portuguese speakers each constituted approximately 1% of all eligible voters. Vietnamese speakers exceeded 2% of all eligible voters in 1 Precinct in the western half of the City. Portuguese speakers did not exceed 2% of eligible voters in any Precinct.

Haitian Creole, Khmer, Chinese, and Russian speakers each represented well under 1% of Chelsea's total eligible voters. None exceeded 2% of eligible voters in any Precinct.

City of Lowell

According to the 2000 Census, there were approximately 6,200 eligible voters who spoke one of the languages of interest at home and spoke English less than very well in the City of

Lowell. Approximately 45% of these spoke Spanish at home. Spanish speakers were concentrated in the center of Lowell and along lines radiating north, south and east from the City center. For Lowell as a whole, Spanish speakers constituted approximately 4.5% of all eligible voters. Spanish speakers exceeded 10% of all eligible voters in 4 voting Precincts, 5% in 13 Precincts, and 2% of all eligible voters in 24 Precincts.

The next largest group was Khmer speakers. They represented approximately 23% of the limited English eligible voters of interest in Lowell. Khmer speakers were concentrated in the center and southwestern portions of the City. For Lowell as a whole, Khmer speakers constituted approximately 2.3% of all eligible voters. Khmer speakers exceeded 2% of all eligible voters in 9 voting Precincts, 5% of all eligible voters in 3 Precincts, and 10% of all eligible voters in 1 Precinct, and all in the center of Lowell.

Portuguese speakers constituted approximately 21% of the languages of interest. Portuguese speakers were concentrated toward the center and southeastern portions of the City. For Lowell as a whole, Portuguese speakers constituted approximately 2% of all eligible voters. They exceeded 2% of all eligible voters in 8 voting Precincts, 5% of all eligible voters in 2 Precincts, and 10% of all eligible voters in 1 Precinct.

Vietnamese, Chinese, Russian and Haitian Creole speakers each constituted well under 1% of all eligible voters in Lowell. Vietnamese speakers exceeded 2% of eligible voters in 3 voting Precincts in the center and northern areas of Lowell. None of the other language groups exceeded 2% of eligible voters in any Precinct.

City of Malden

According to the 2000 Census, there were approximately 3,100 eligible voters who spoke one of the languages of interest at home and spoke English less than very well in the City of Malden. Approximately 35% of these spoke Chinese at home. Chinese speakers were concentrated in the western half of Malden. For Malden as a whole, Chinese speakers constituted slightly less than 3% of all eligible voters. Chinese speakers exceeded 2% of all

eligible voters in 11 voting Precincts, but did not exceed 5% in any Precinct.

The next largest group was Spanish speakers. They made up 19% of eligible voters of interest. Spanish speakers were concentrated in the southern portion of Malden near the Revere border. For Malden as a whole, Spanish speakers constituted approximately 1.6% of all eligible voters. They exceeded 2% of all eligible voters in 3 voting Precincts, but did not exceed 5% in any Precinct.

Portuguese speakers represented 13% of the eligible voters of interest. Portuguese speakers were concentrated in the southern portion of Malden near the Revere border. For Malden as a whole, Portuguese speakers constituted approximately 1% of all eligible voters. They exceeded 2% of all eligible voters in 1 voting Precinct, but did not exceed 5% in any Precinct.

Vietnamese speakers represented approximately 12% of the eligible voters of interest. Vietnamese speakers were fairly dispersed across Malden. For Malden as a whole, Vietnamese speakers constituted approximately 1% of all eligible voters. They exceeded 2% of all eligible voters in 2 voting Precincts in the south central part of the City, but did not exceed 5% in any Precinct.

Russian, Haitian Creole and Khmer speakers each constituted less than 1% of all eligible voters in Malden as a whole. Russian speakers exceeded 2% of all eligible voters in 2 voting Precincts in the north central area of Malden, but did not exceed 5% in any Precinct. Neither of the remaining two language groups exceeded 2% of eligible voters in any Precinct.

City of Quincy

According to the 2000 Census, there were approximately 3,600 eligible voters who spoke one of the languages of interest at home and spoke English less than very well in the City of Quincy. The vast majority, approximately 67%, spoke Chinese at home. Chinese speakers were fairly dispersed across Quincy, with a slight concentration in the northwest. For Quincy as a

whole, Chinese speakers constituted approximately 3.7% of all eligible voters. Chinese speakers exceeded 10% of all eligible voters in 5 voting Precincts, and 5% of all eligible voters in 11 Precincts, mostly in the northwest. They exceeded 2% of eligible voters in all 28 of Quincy's voting Precincts.

All other language groups of interest each constituted well under 1% of eligible voters in the City. Vietnamese speakers exceeded 2% of eligible voters in 3 voting precincts in the northern and eastern portions of Quincy, but did not exceed 5% in any Precinct. None of the other language groups of interest exceeded 2% of eligible voters in any Precinct.

City of Somerville

According to the 2000 Census, there were just under 5,000 eligible voters who spoke one of the languages of interest at home and spoke English less than very well in the City of Somerville. Approximately 45% of these spoke Portuguese at home. Portuguese speakers were concentrated in the eastern half of Somerville. For Somerville as a whole, Portuguese speakers constituted approximately 4.3% of all eligible voters. Portuguese speakers exceeded 2% of all eligible voters in 14 voting Precincts, 5% in 7 Precincts, and 10% in 1 Precinct.

The next largest group was Spanish speakers. They made up approximately 32% of eligible voters of interest. Spanish speakers were concentrated in the eastern portion of Somerville. For Somerville as a whole, Spanish speakers constituted approximately 3% of all eligible voters. They exceeded 2% of all eligible voters in 6 voting Precincts and 5% of voters in 4 Precincts, all in the northeastern portion of the City, but did not exceed 10% in any Precinct.

Chinese speakers made up approximately 10% of the eligible voters of interest. Chinese speakers were fairly dispersed across Somerville. For Somerville as a whole, Chinese speakers constituted approximately 1% of all eligible voters. They did not exceed 2% of eligible voters in any voting Precinct.

Haitian Creole, Russian, Vietnamese and Khmer speakers each constituted well under 1%

of all eligible voters in Somerville. Haitian Creole speakers exceeded 2% of eligible voters in 2 voting Precincts in the northeastern section of Somerville. None of the other language groups exceeded 2% of eligible voters in any Precinct.

Discussion

In order to properly document the needs of limited English speaking voters, there is a need to conduct and maintain a database dedicated to these specific concerns. As far as we could determine, no such database currently exists. Using existing public resources to estimate the numbers and percentages of eligible voters who speak a language other than English at home and speak English less than very well is fraught with complications. As far as we could discern, the only source of useable data came from the U.S. Census. However, the Census does not provide these numbers in the combinations desired. For example, the Census provides tables listing the numbers of Asian language speakers by age in most Census Tracts, but not how many of these are Chinese as opposed to Vietnamese speakers. In addition, the Census provides numbers of citizens who claim Chinese *ethnicity*, but not citizens who *speak* Chinese, let alone citizens who speak Chinese and speak English less than very well. In order to calculate the desired numbers, we were forced to use percentage estimates for each attribute within the communities of interest and then multiply these to arrive at the desired estimates (see Appendices). As a general rule, multiple calculations to generate statistics inevitably increase the likelihood of propagating errors. In order to minimize the potential for error, we used two separate sets of estimates for municipal-level and precinct-level numbers. In the latter case we used more generalized estimates (e.g. limited English Asian speakers) that were specific to individual Census Tracts. In the former case we had access to more detailed attributes of interest (e.g. limited English Chinese speakers), but generalized across the entire Commonwealth. Comparisons between these two methods at the municipal level showed modest variation in most cases.

As requested, we attempted to calculate trends to identify areas that show growth or decline in the eligible voters of interest. We used data from the 1990 and 2000 Censuses, as well as data recently made available by the Census's American Community Survey for the 2005 to 2007 period. These calculations faced the same limitations as described above. In addition, data for the American Community Survey was only available for the cities of Boston and Cambridge. More problematically, the American Community Survey data appear to be inconsistent with

Census 2000 data, and were thus unusable. Below are tables showing differences for Boston and Cambridge between the 1990 and 2000 Censuses.

BOSTON - Number of Eligible Voters by Language Who Speak English Less Than Very Well

Year	Spanish	Chinese	Vietnamese	Khmer	Portuguese	Russian	Haitian Creole
1990	19237	4623	1366	333	2506	1041	N/A
2000	19144	5219	3117	95	3069	3250	3716

CAMBRIDGE - Number of Eligible Voters by Language Who Speak English Less Than Very Well

Year	Spanish	Chinese	Vietnamese	Khmer	Portuguese	Russian	Haitian Creole
1990	1423	733	40	2	897	41	N/A
2000	1838	1186	85	11	738	411	540

At this point in time, we do not find it possible to reliably predict trends in growth or decline of these groups. The American Community Survey data is limited to municipalities with larger population sizes and the numbers that are available appear to be unstable. In order to make more reliable predictions, we will need to wait for the 2010 Census data.

Tables and Figures

Number of Eligible Voters by Language Who Speak English Less Than Very Well (2000 Census)

Municipality	Spanish	Chinese	Vietnamese	Khmer	Portuguese	Russian	Haitian Creole
City of Boston	19,144	5,219	3,117	95	3,069	3,250	3,716
Town of Brookline	599	913	10	26	105	1,124	37
City of Cambridge	1,838	1,186	85	11	738	411	540
City of Chelsea	3,514	44	180	45	159	23	53
City of Lowell	2,818	228	389	1,417	1,288	78	37
City of Malden	600	1,097	378	41	411	346	292
City of Quincy	445	2,409	373	25	158	143	33
City of Somerville	1,574	515	68	7	2,277	112	386
Total	30,532	11,611	4,600	1,667	8,204	5,486	5,095

Percentage of Eligible Voters by Language Who Speak English Less Than Very Well (2000 Census)

Municipality	Spanish	Chinese	Vietnamese	Khmer	Portuguese	Russian	Haitian Creole
City of Boston	4.93%	1.34%	0.80%	0.02%	0.79%	0.84%	0.96%
Town of Brookline	1.49%	2.26%	0.02%	0.07%	0.26%	2.79%	0.09%
City of Cambridge	2.57%	1.66%	0.12%	0.02%	1.03%	0.57%	0.75%
City of Chelsea	21.00%	0.26%	1.08%	0.27%	0.95%	0.14%	0.32%
City of Lowell	4.48%	0.36%	0.62%	2.25%	2.05%	0.12%	0.06%
City of Malden	1.62%	2.95%	1.02%	0.11%	1.10%	0.93%	0.79%
City of Quincy	0.68%	3.71%	0.57%	0.04%	0.24%	0.22%	0.05%
City of Somerville	3.02%	0.99%	0.13%	0.01%	4.37%	0.21%	0.74%

Number of Voting Districts where Limited English Speakers Exceed 2% of All Eligible Voters

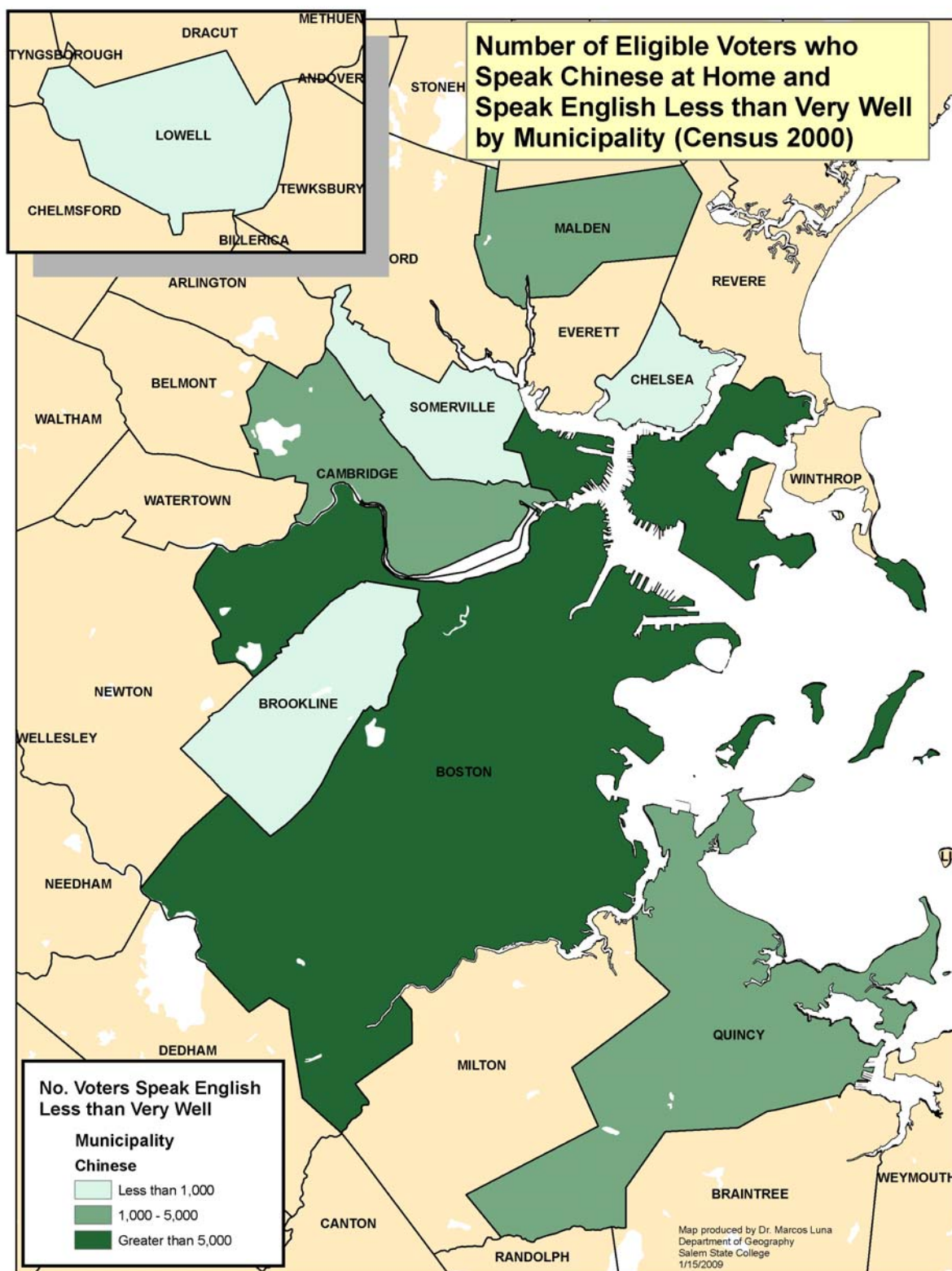
Municipality	Total	Chinese	Vietnamese	Spanish	Haitian Creole	Portuguese	Russian	Khmer
City of Boston	254	39	31	157	50	31	14	0
Town of Brookline	16	6	0	0	0	0	1	0
City of Cambridge	42	4	0	14	3	5	0	0
City of Chelsea	10	0	1	10	0	0	0	0
City of Lowell	33	0	3	24	0	8	0	9
City of Malden	16	11	2	3	0	1	2	0
City of Quincy	30	28	3	0	0	0	0	0
City of Somerville	21	0	0	6	2	14	0	0

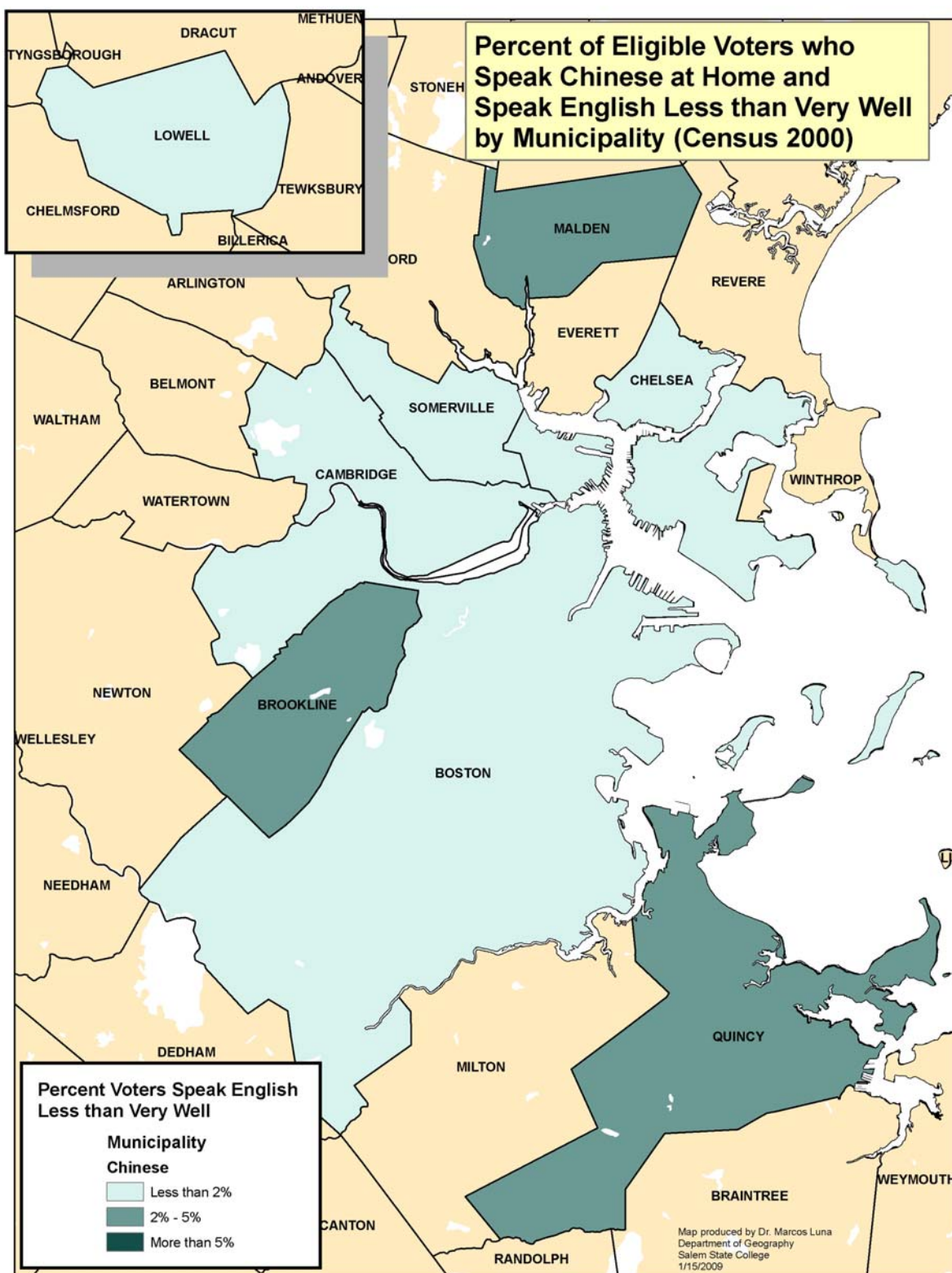
Number of Voting Districts where Limited English Speakers Exceed 5% of All Eligible Voters

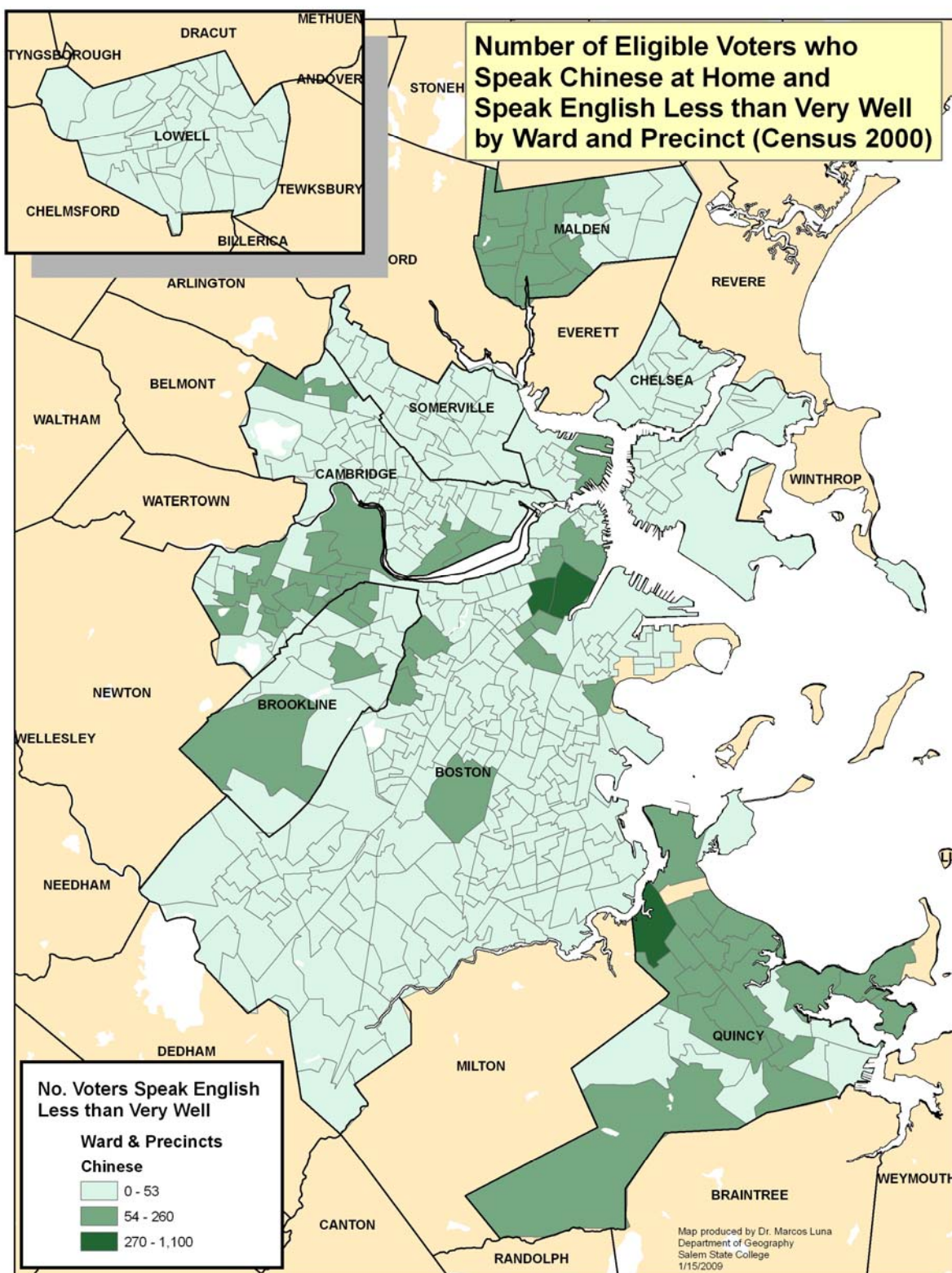
Municipality	Total	Chinese	Vietnamese	Spanish	Haitian Creole	Portuguese	Russian	Khmer
City of Boston	254	9	14	82	13	12	10	0
Town of Brookline	16	0	0	0	0	0	0	0
City of Cambridge	42	0	0	1	1	4	0	0
City of Chelsea	10	0	0	10	0	0	0	0
City of Lowell	33	0	0	13	0	2	0	3
City of Malden	16	0	0	0	0	0	0	0
City of Quincy	30	11	0	0	0	0	0	0
City of Somerville	21	0	0	4	0	7	0	0

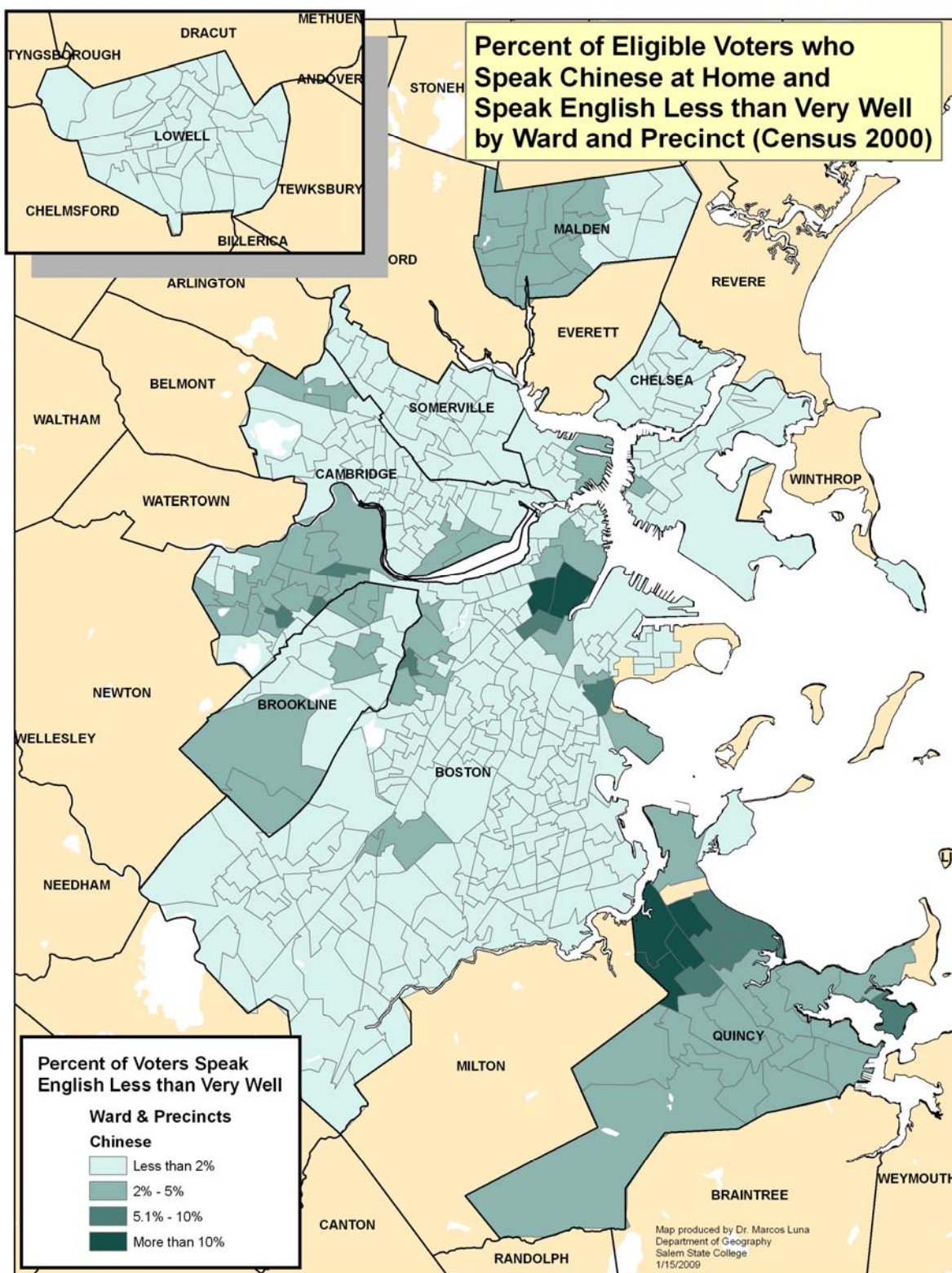
Number of Voting Districts where Limited English Speakers Exceed 10% of All Eligible Voters

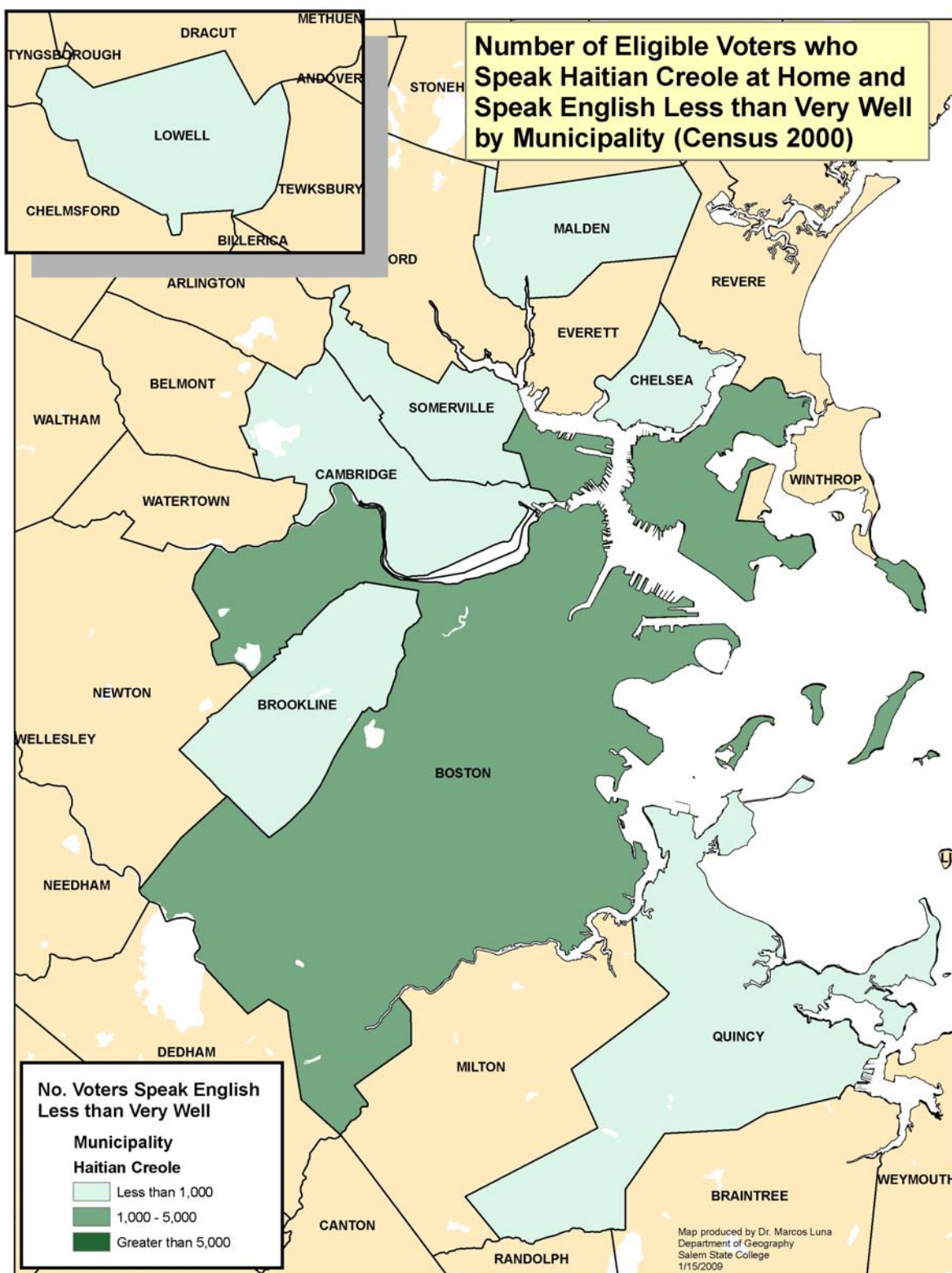
Municipality	Total	Chinese	Vietnamese	Spanish	Haitian Creole	Portuguese	Russian	Khmer
City of Boston	254	2	3	24	0	3	2	0
Town of Brookline	16	0	0	0	0	0	0	0
City of Cambridge	42	0	0	0	0	1	0	0
City of Chelsea	10	0	0	7	0	0	0	0
City of Lowell	33	0	0	4	0	1	0	1
City of Malden	16	0	0	0	0	0	0	0
City of Quincy	30	5	0	0	0	0	0	0
City of Somerville	21	0	0	0	0	1	0	0

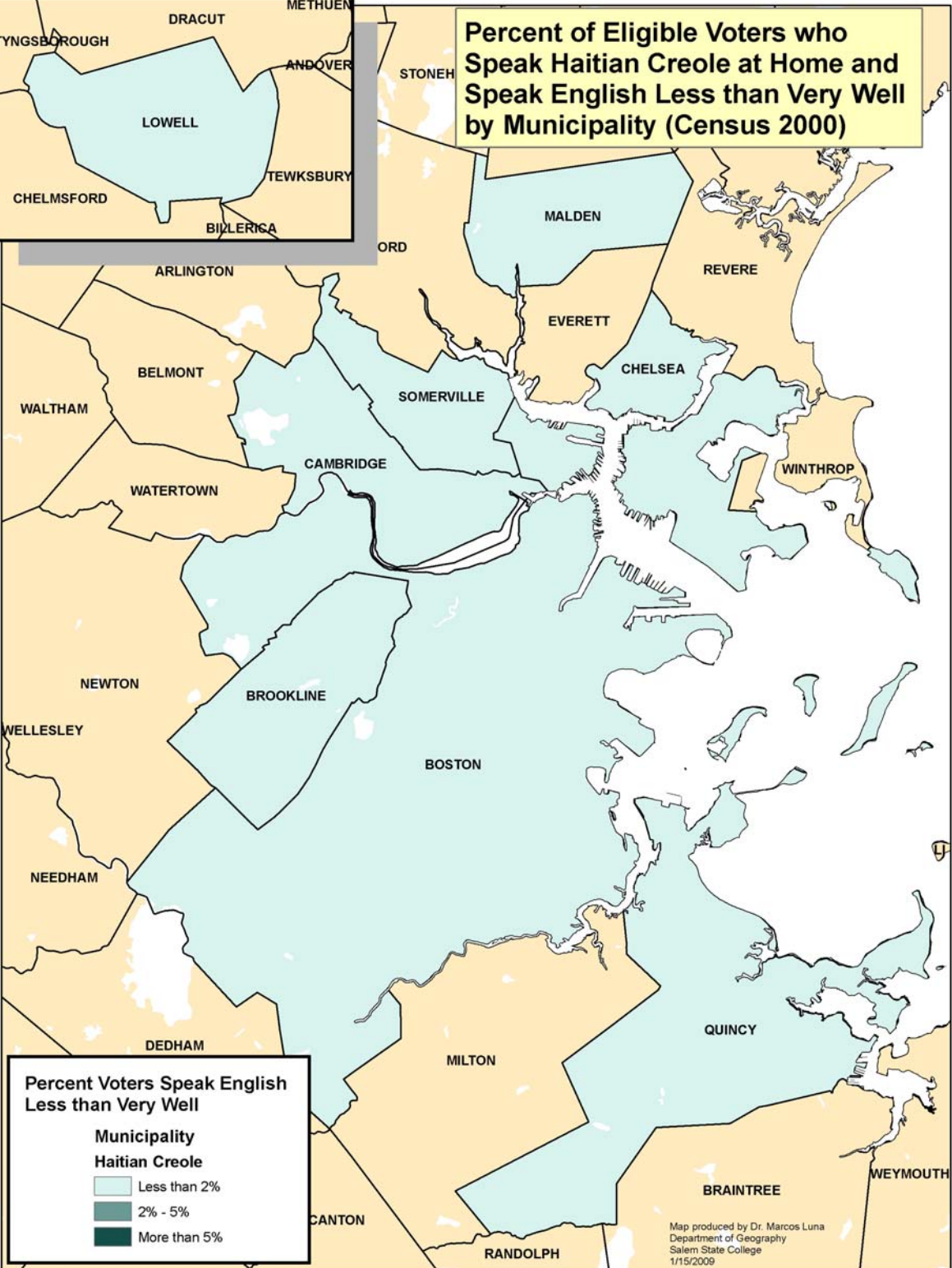


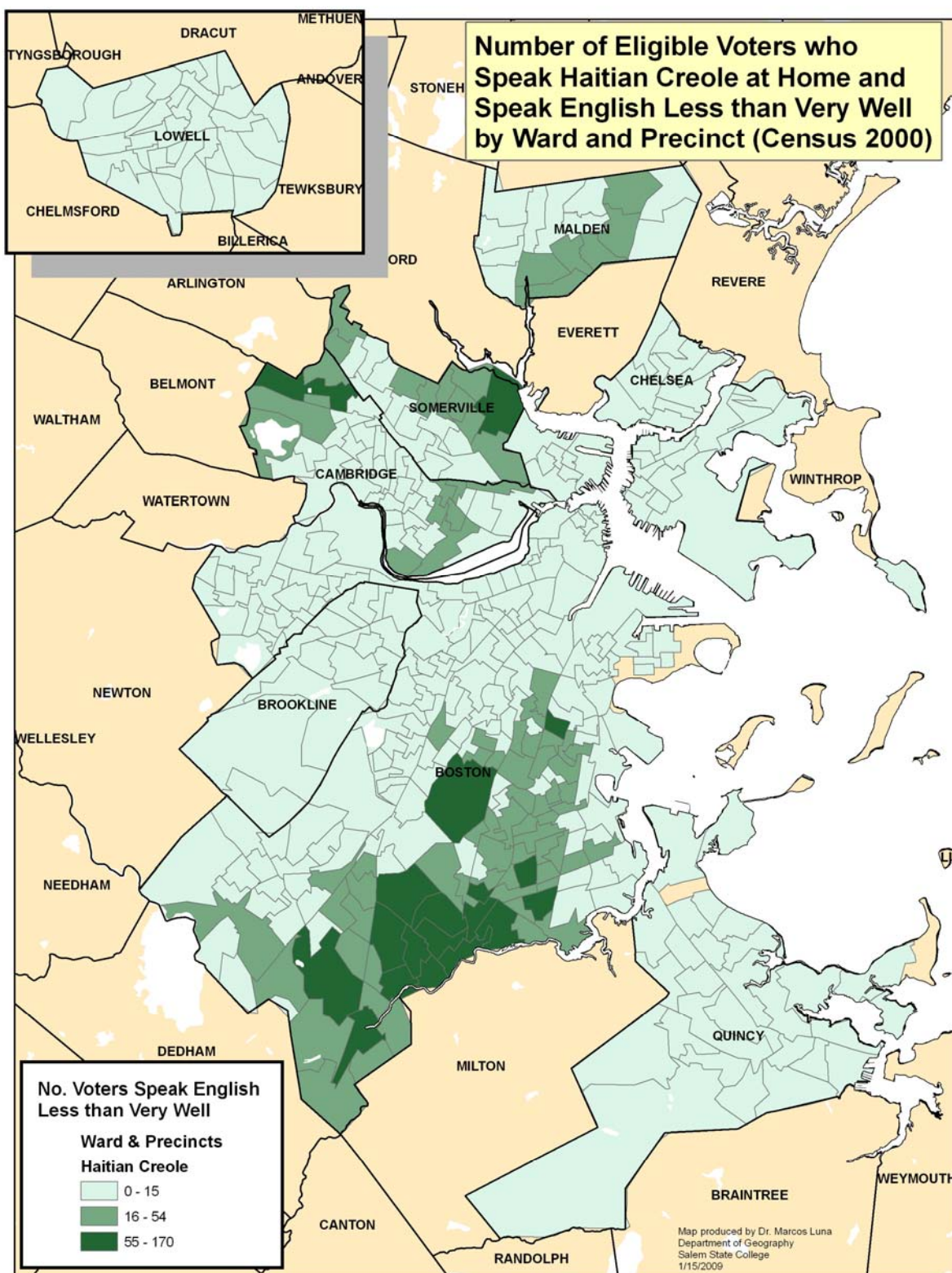


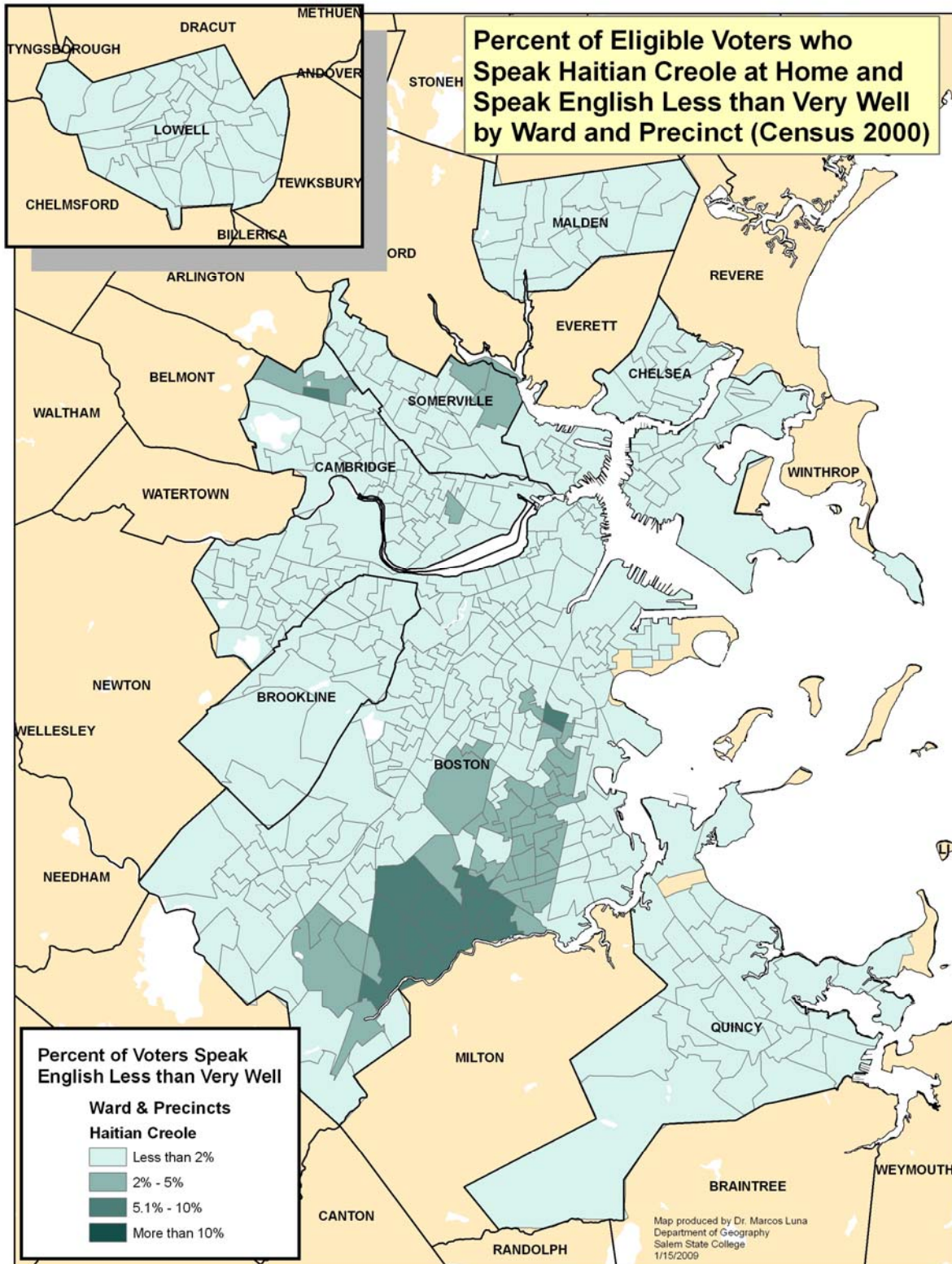


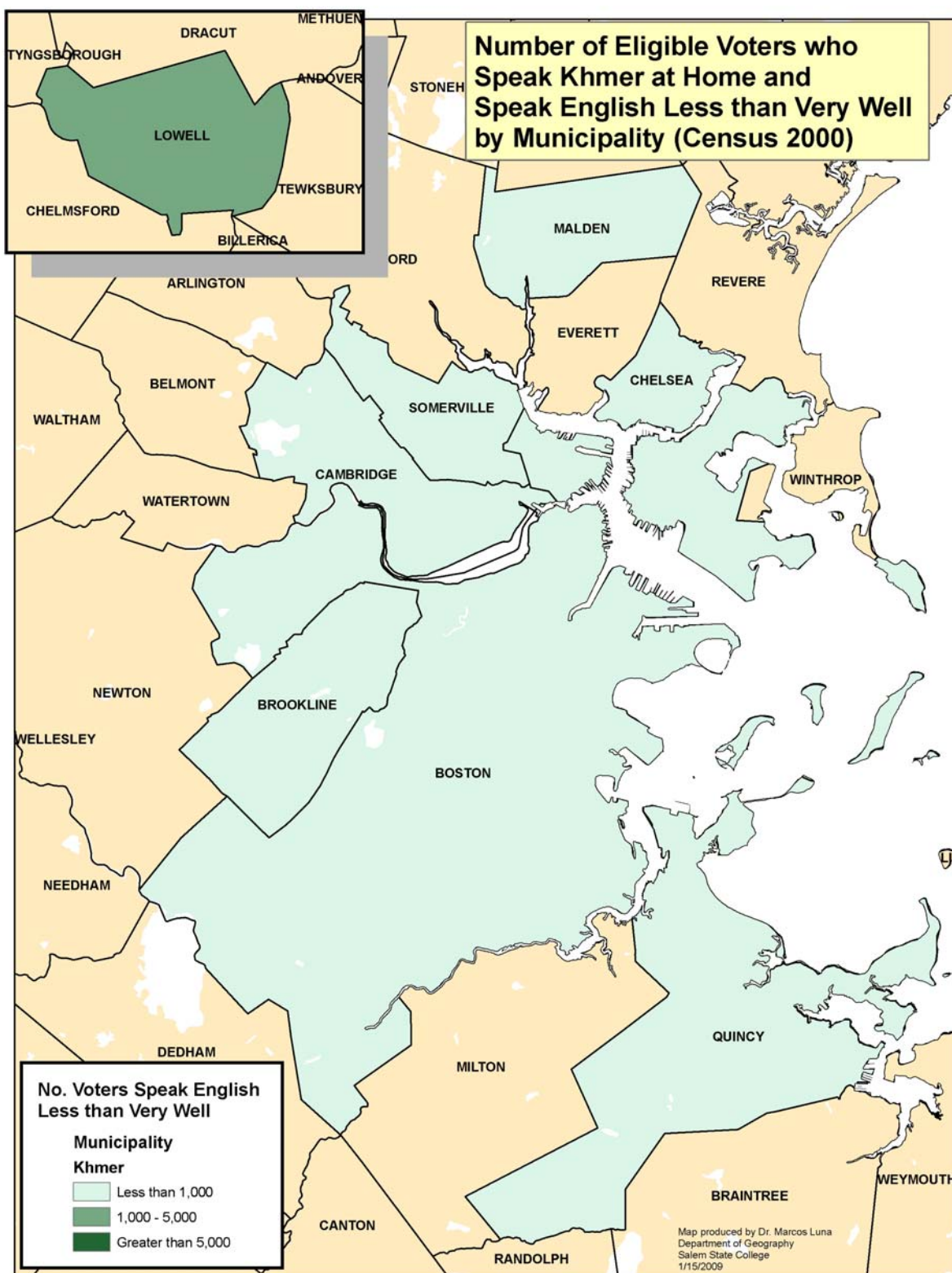


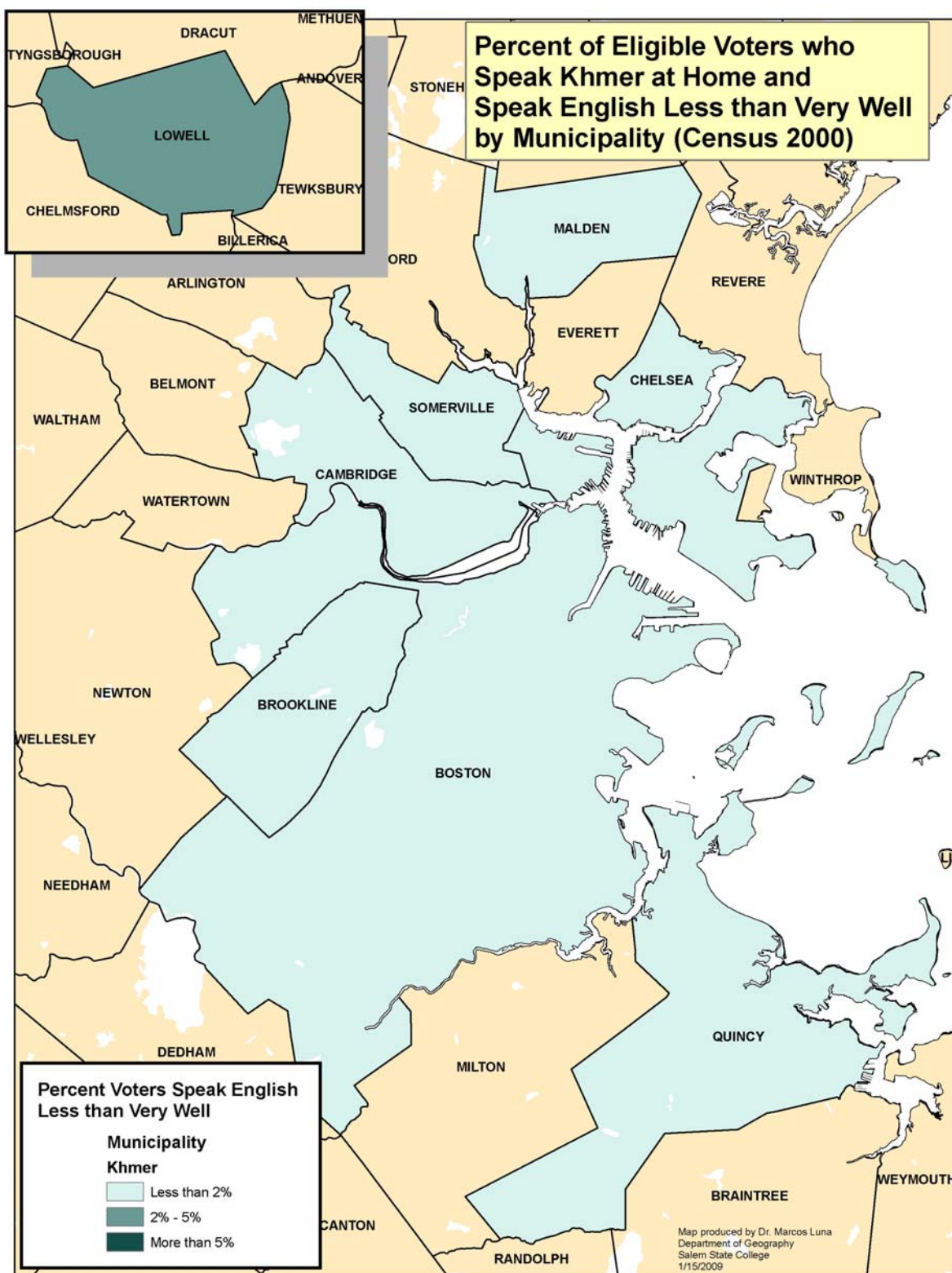


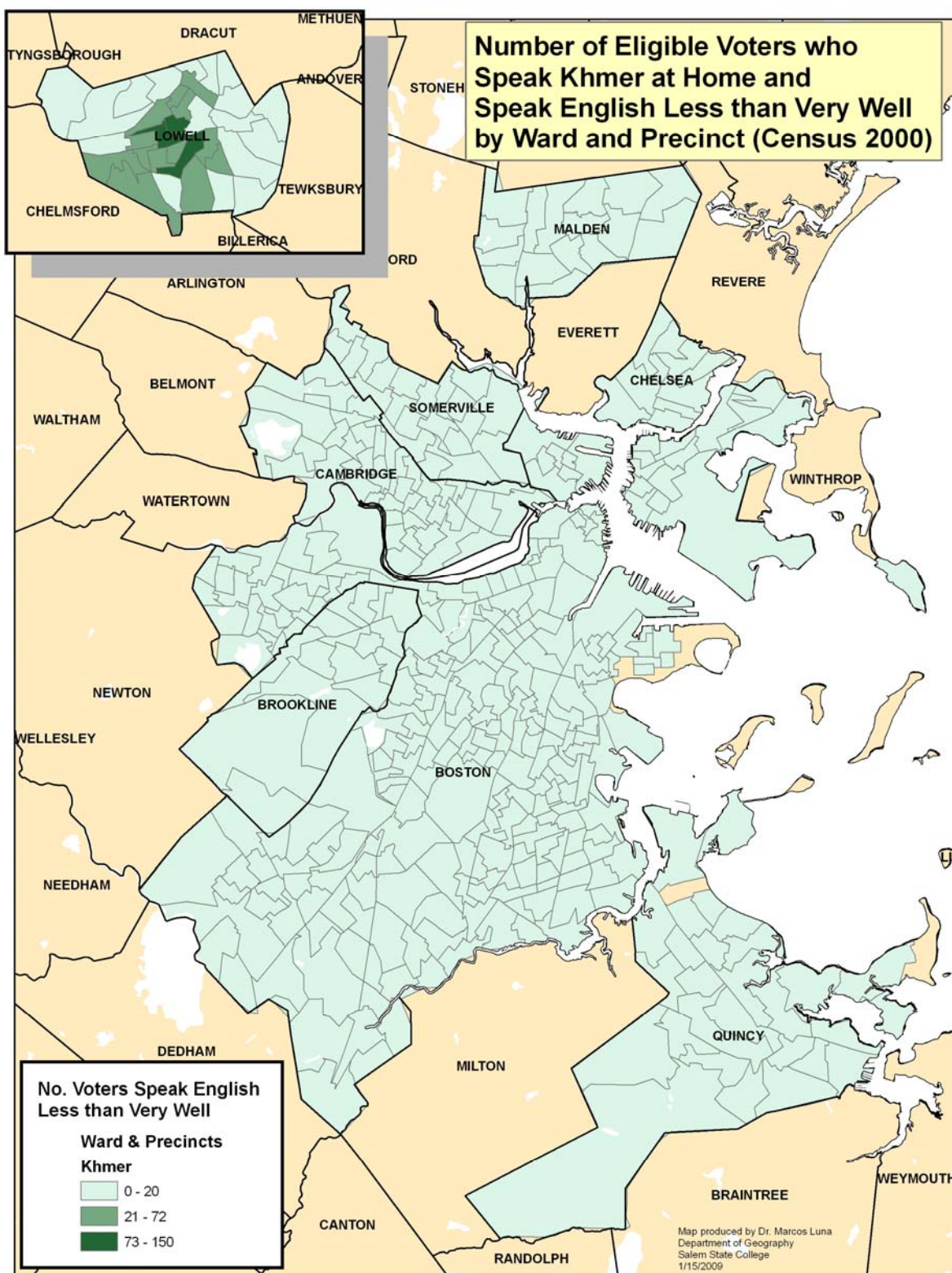


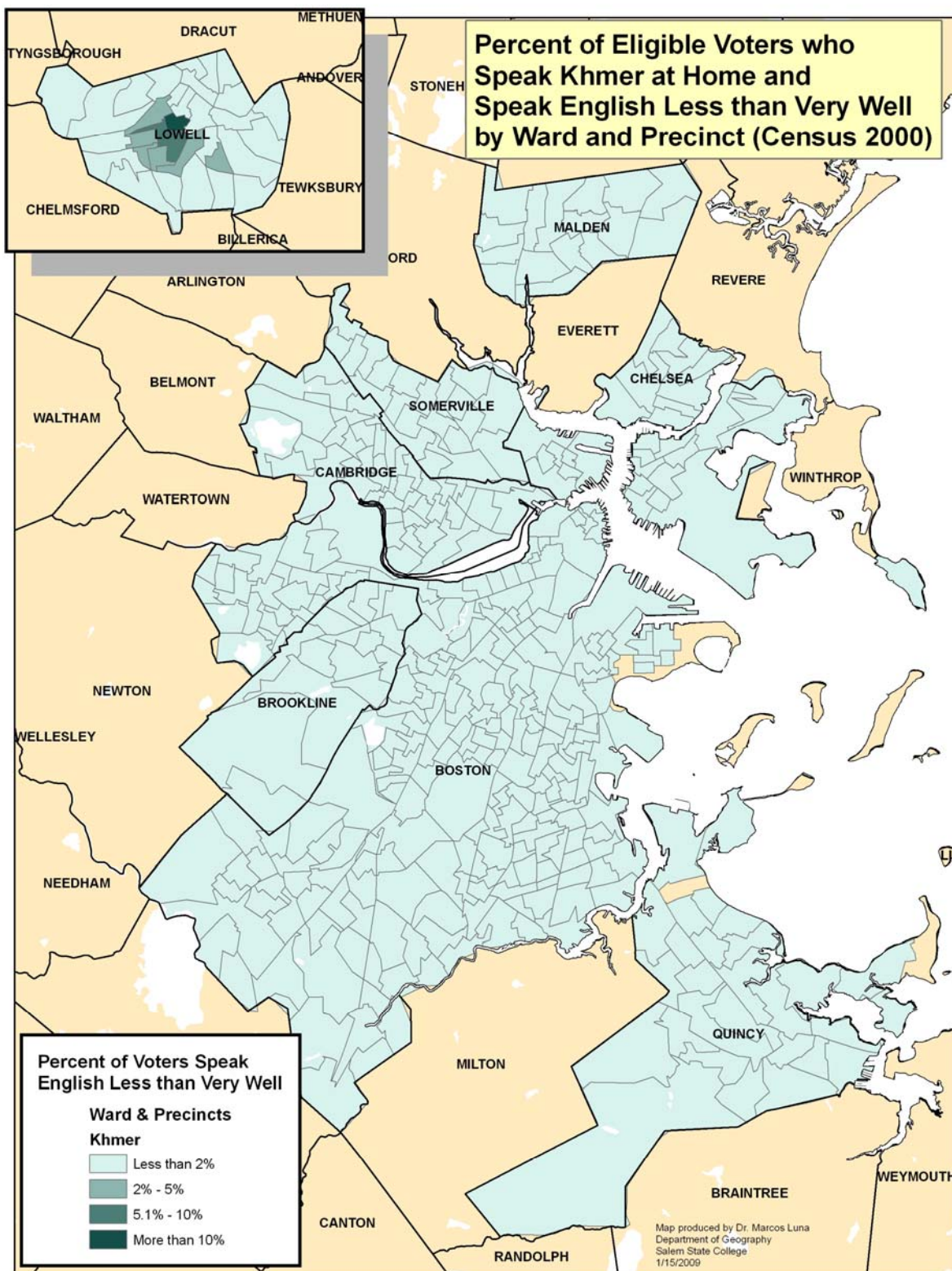


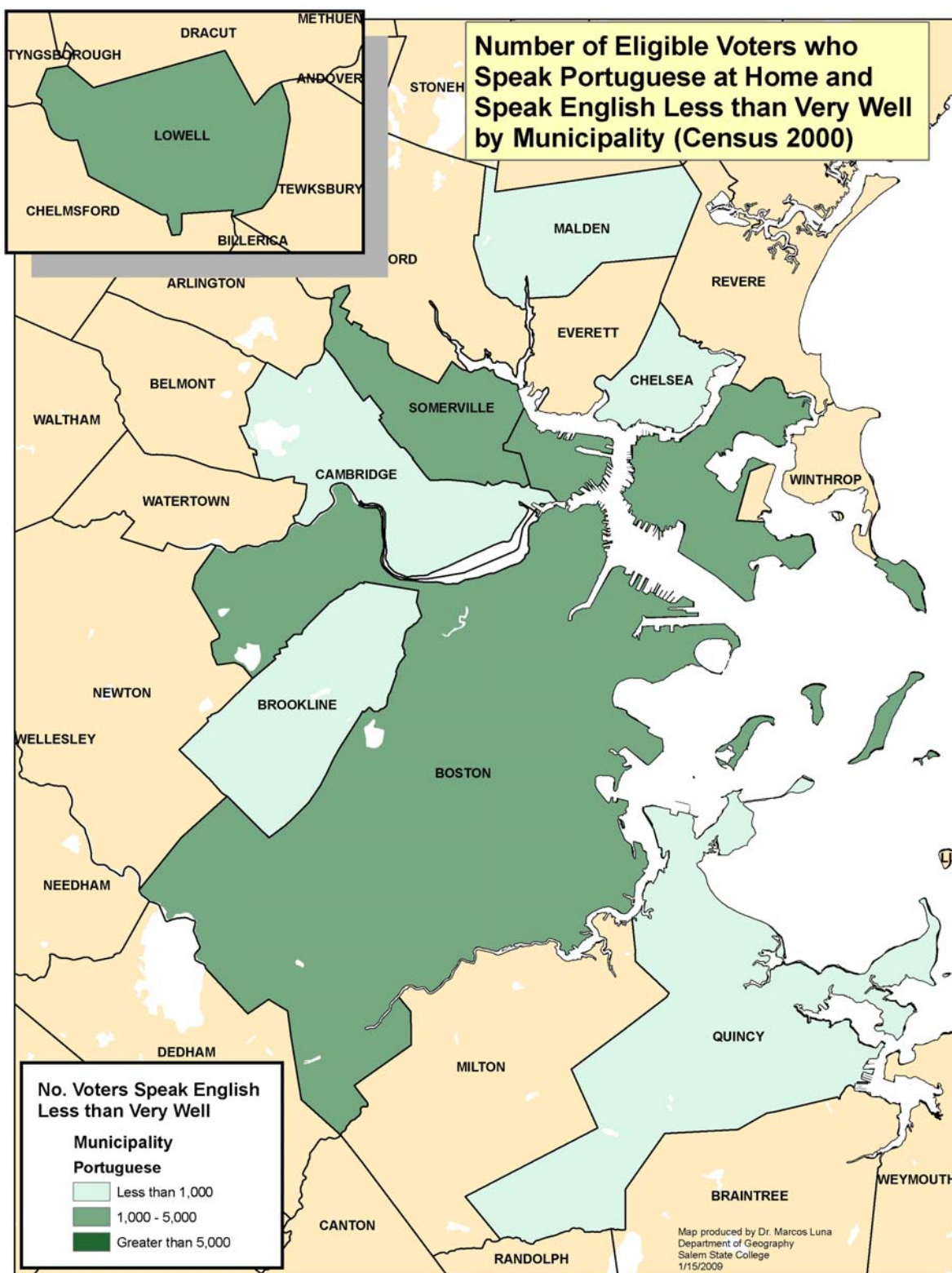


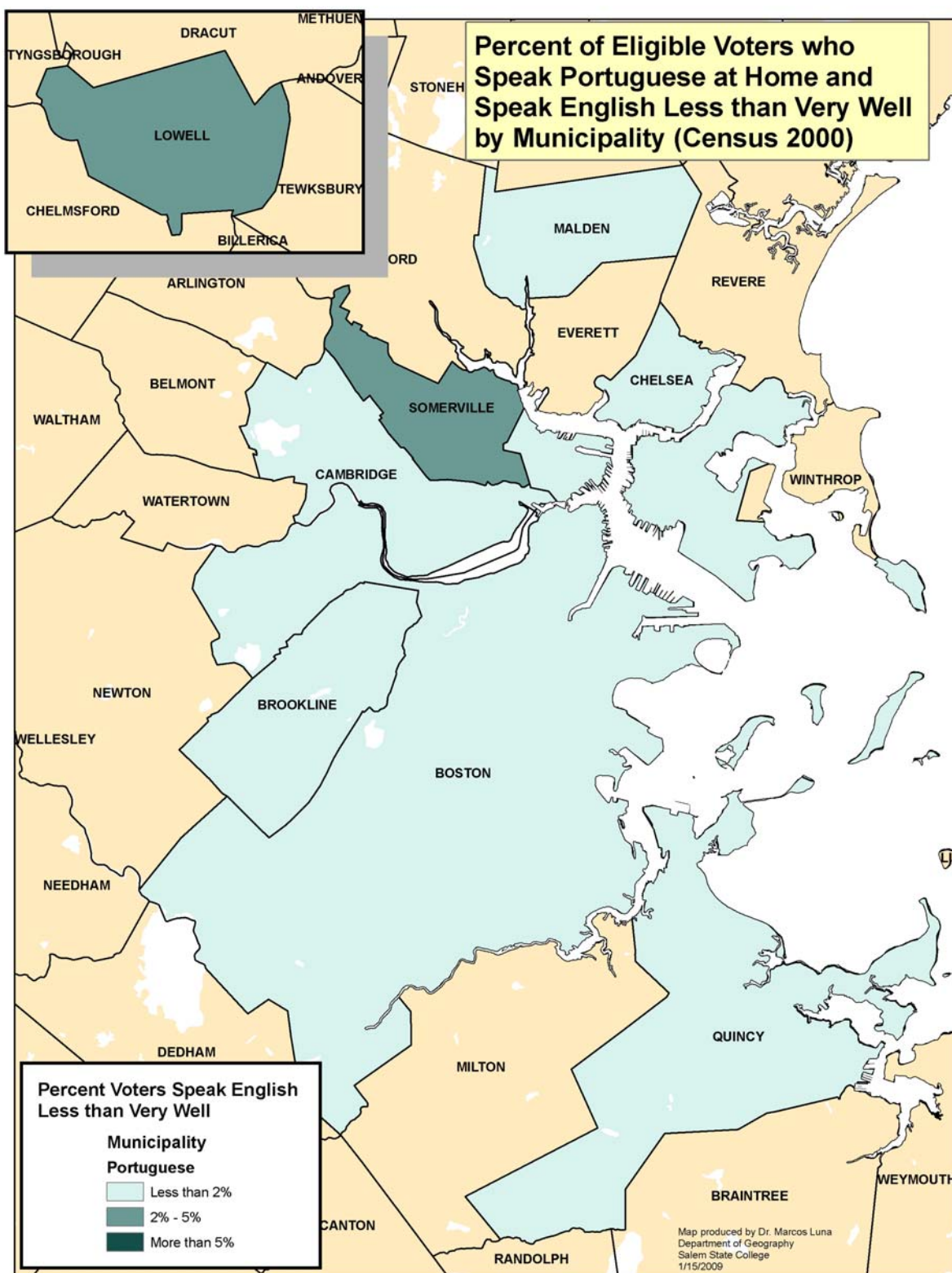


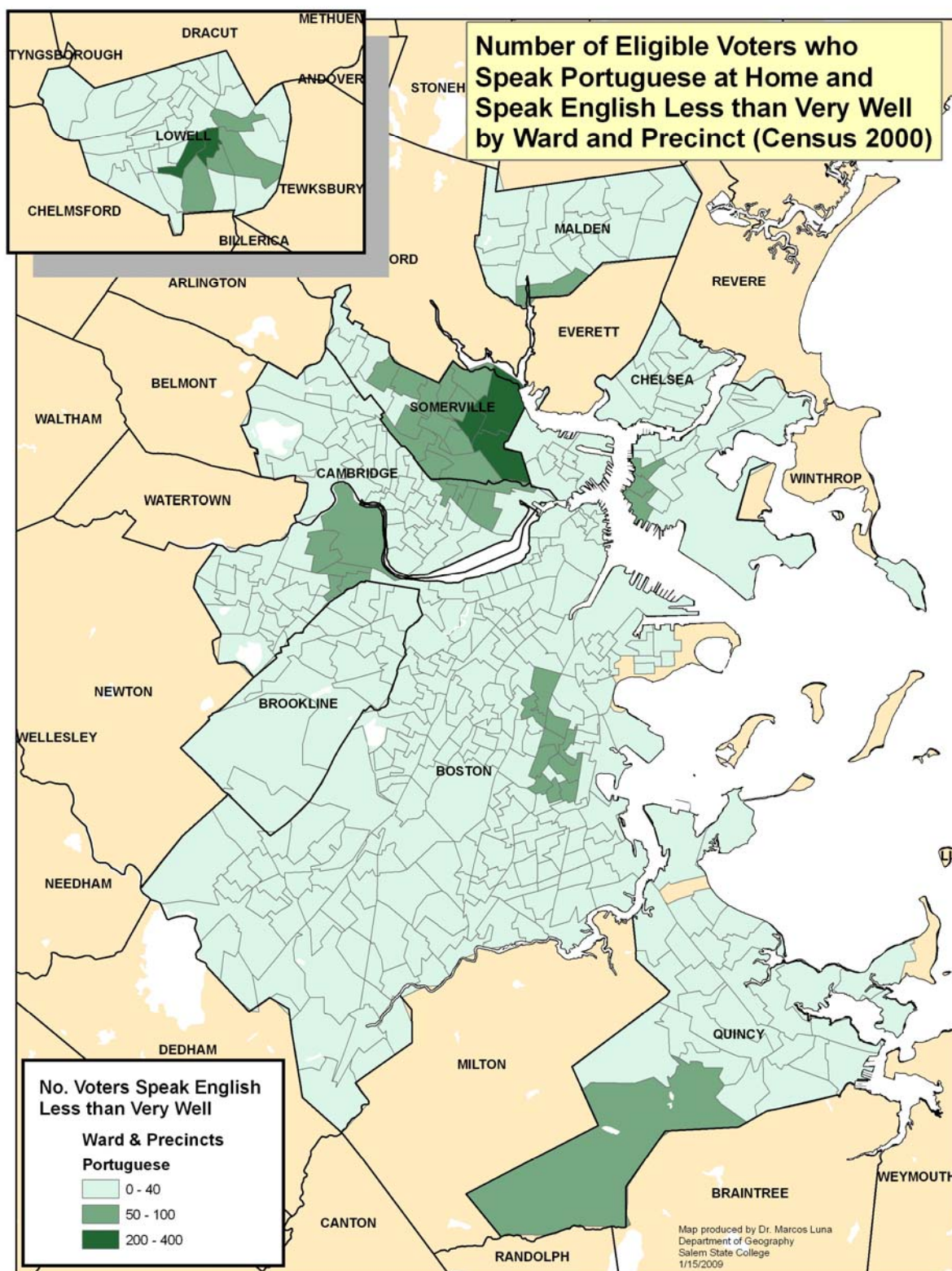


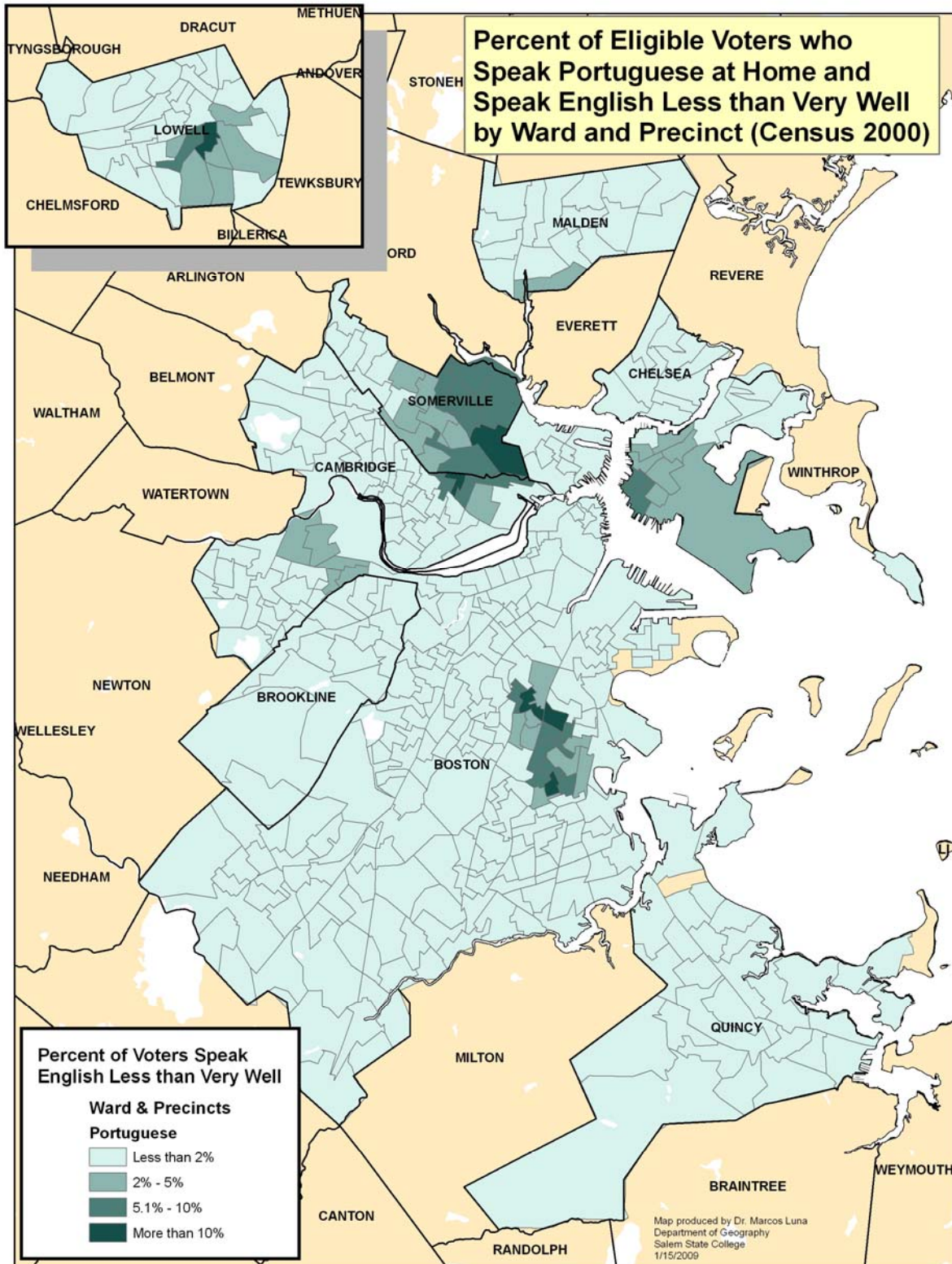


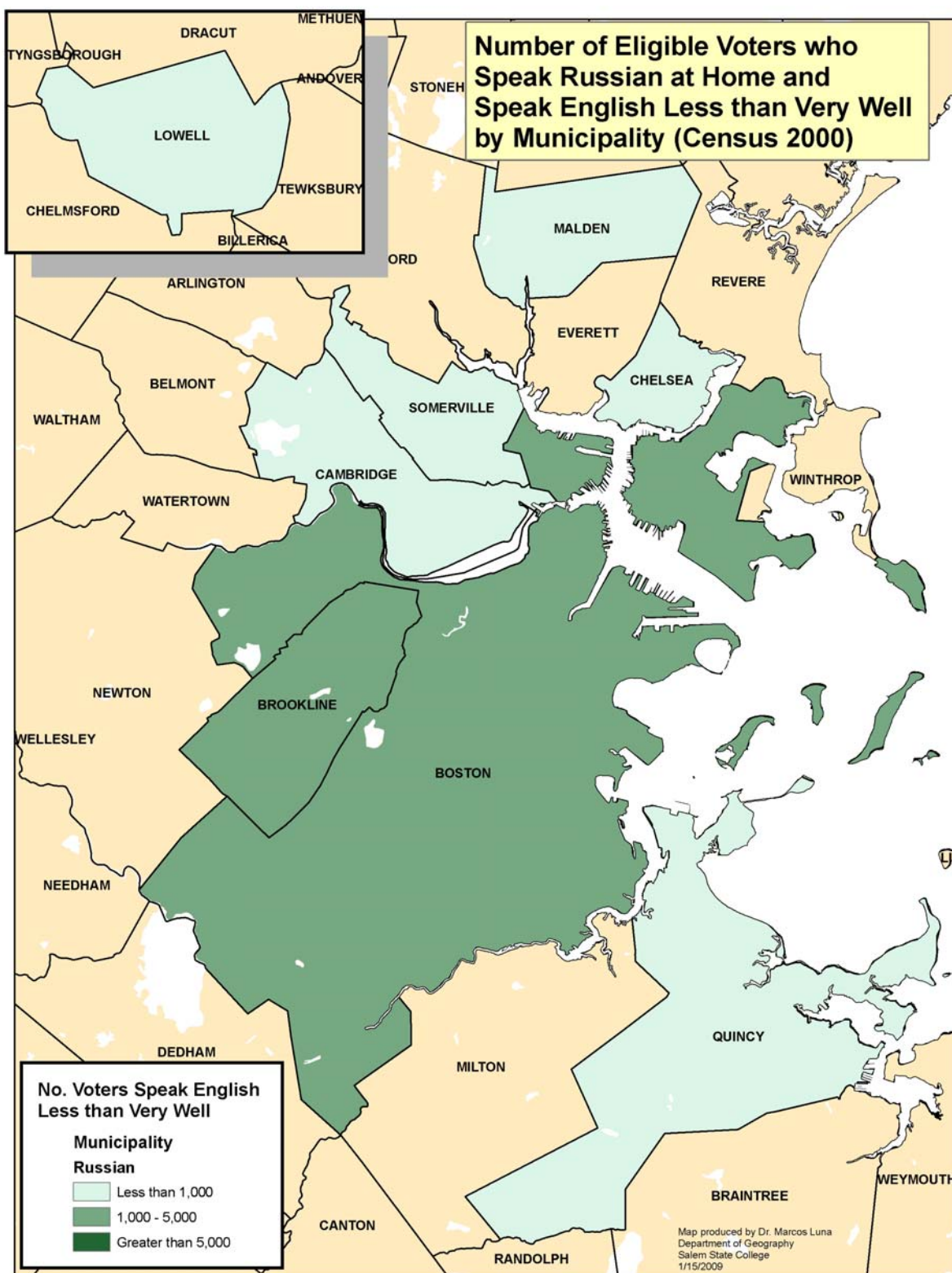


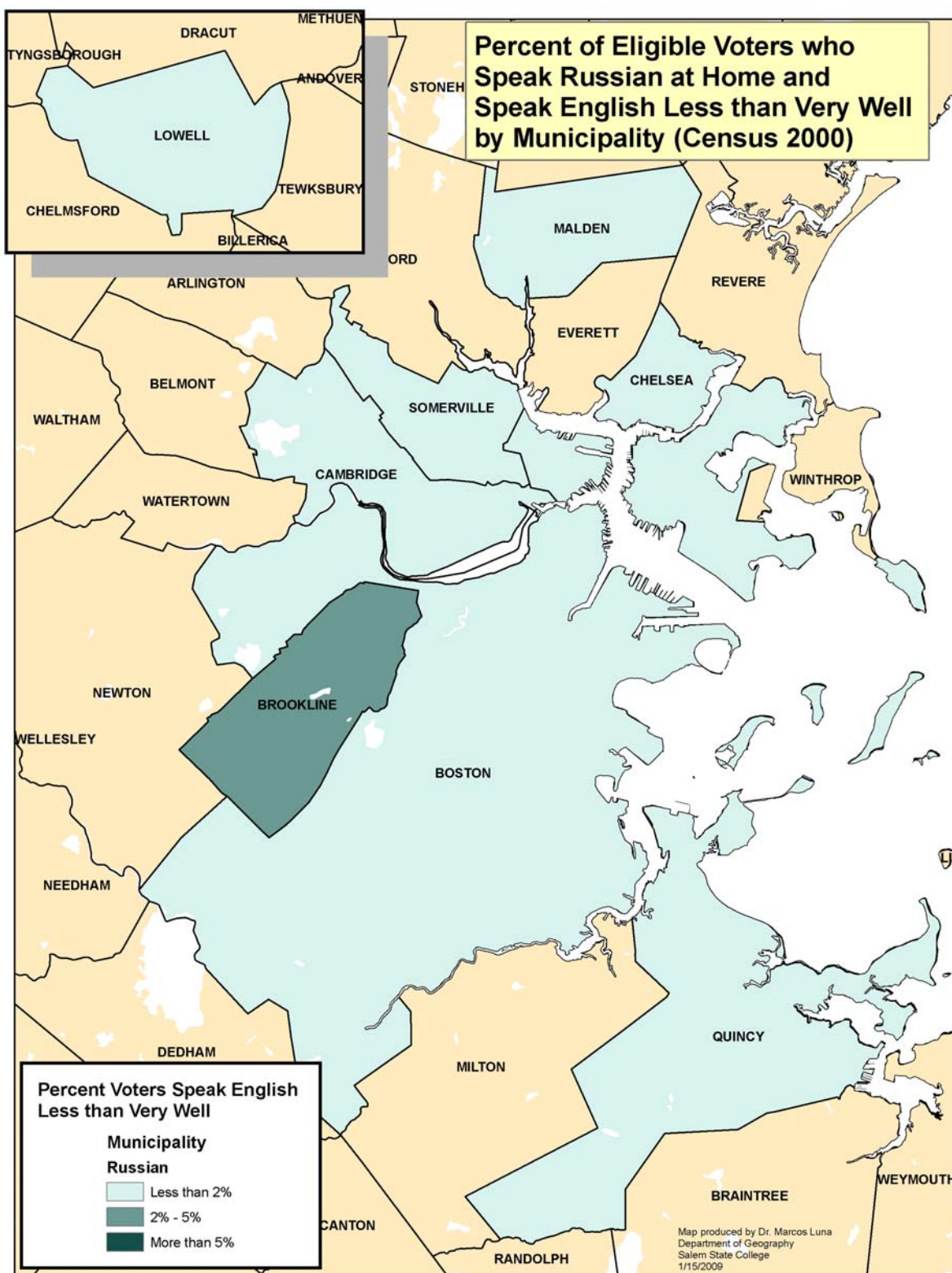


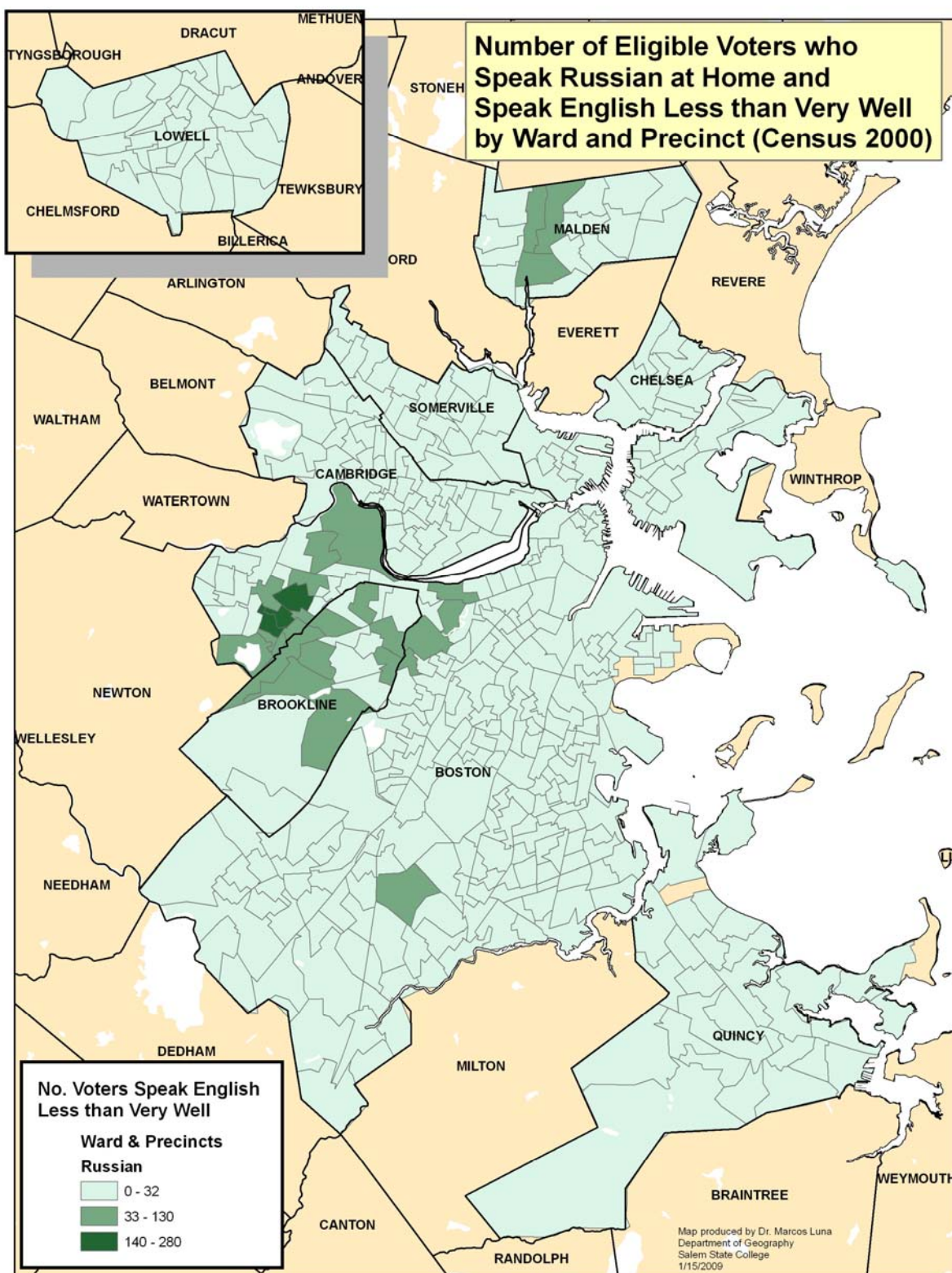


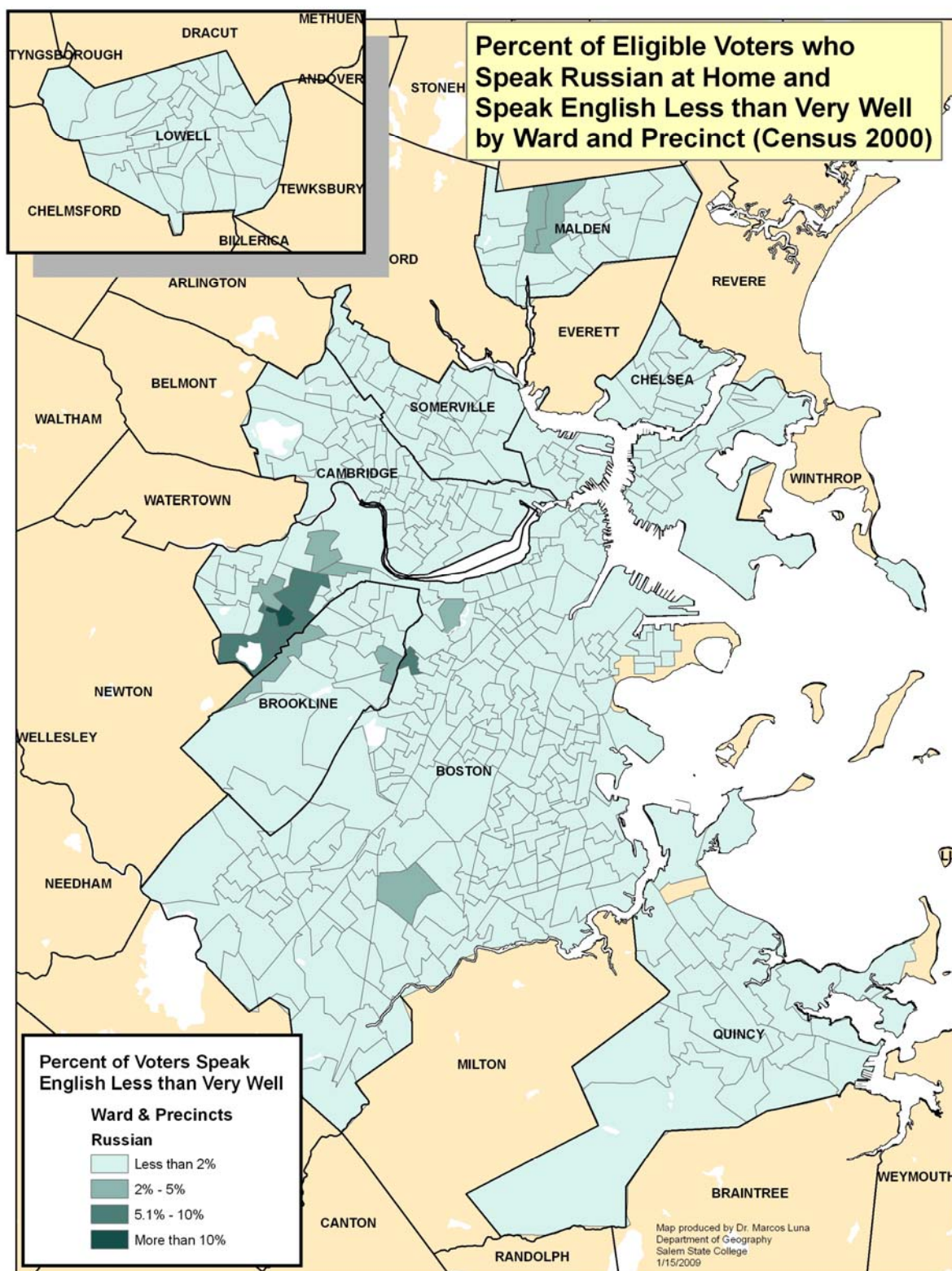


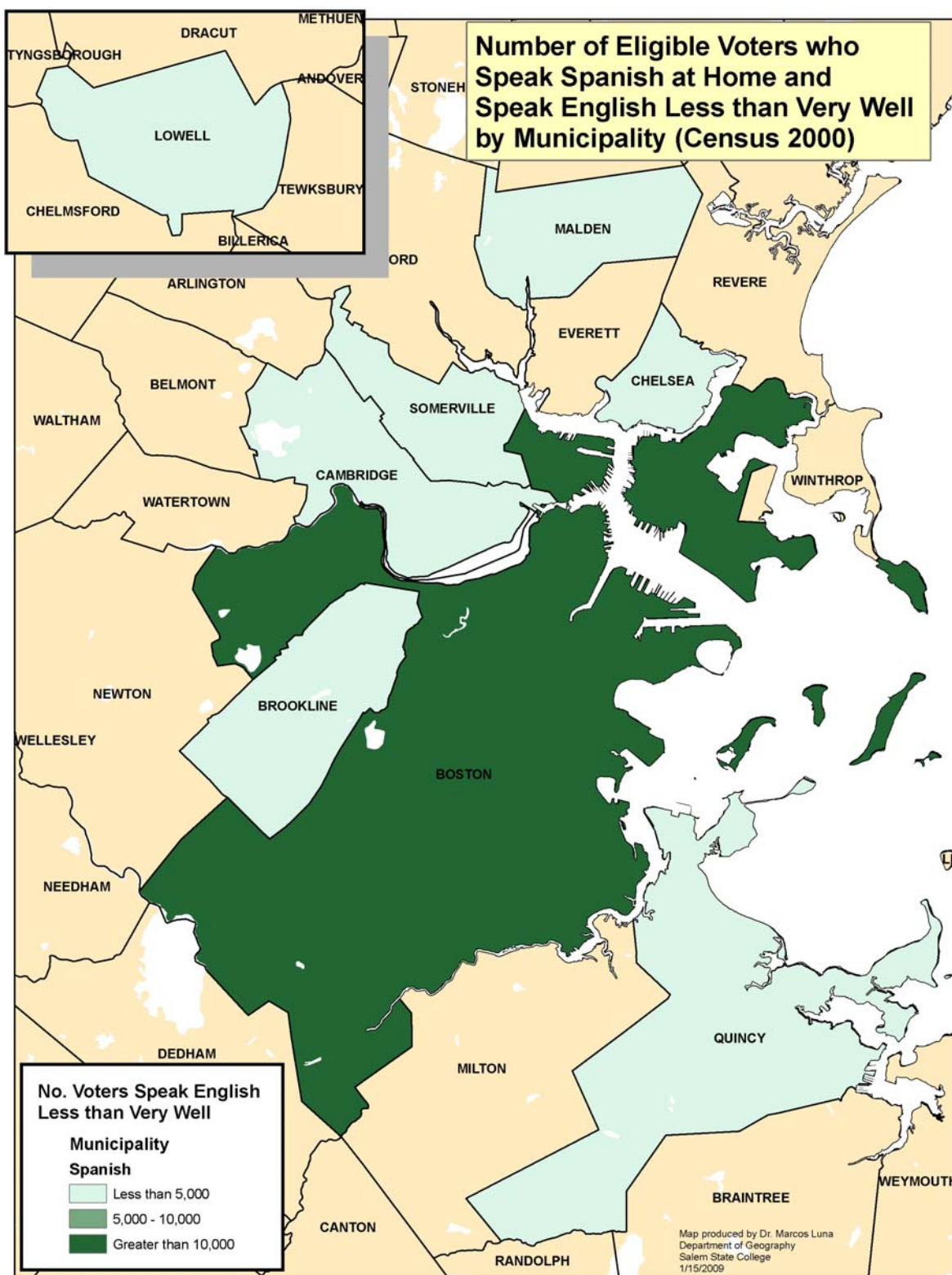


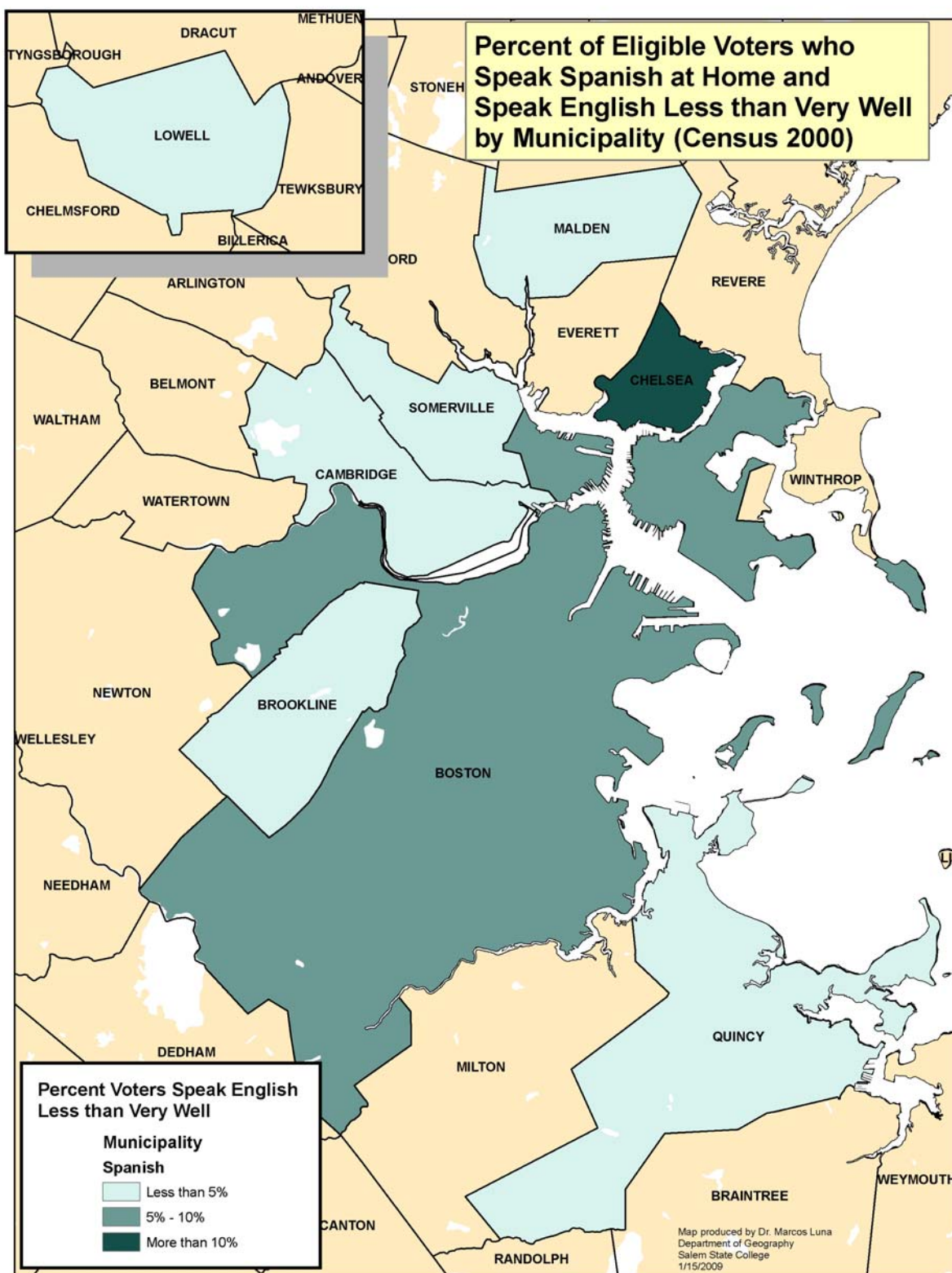


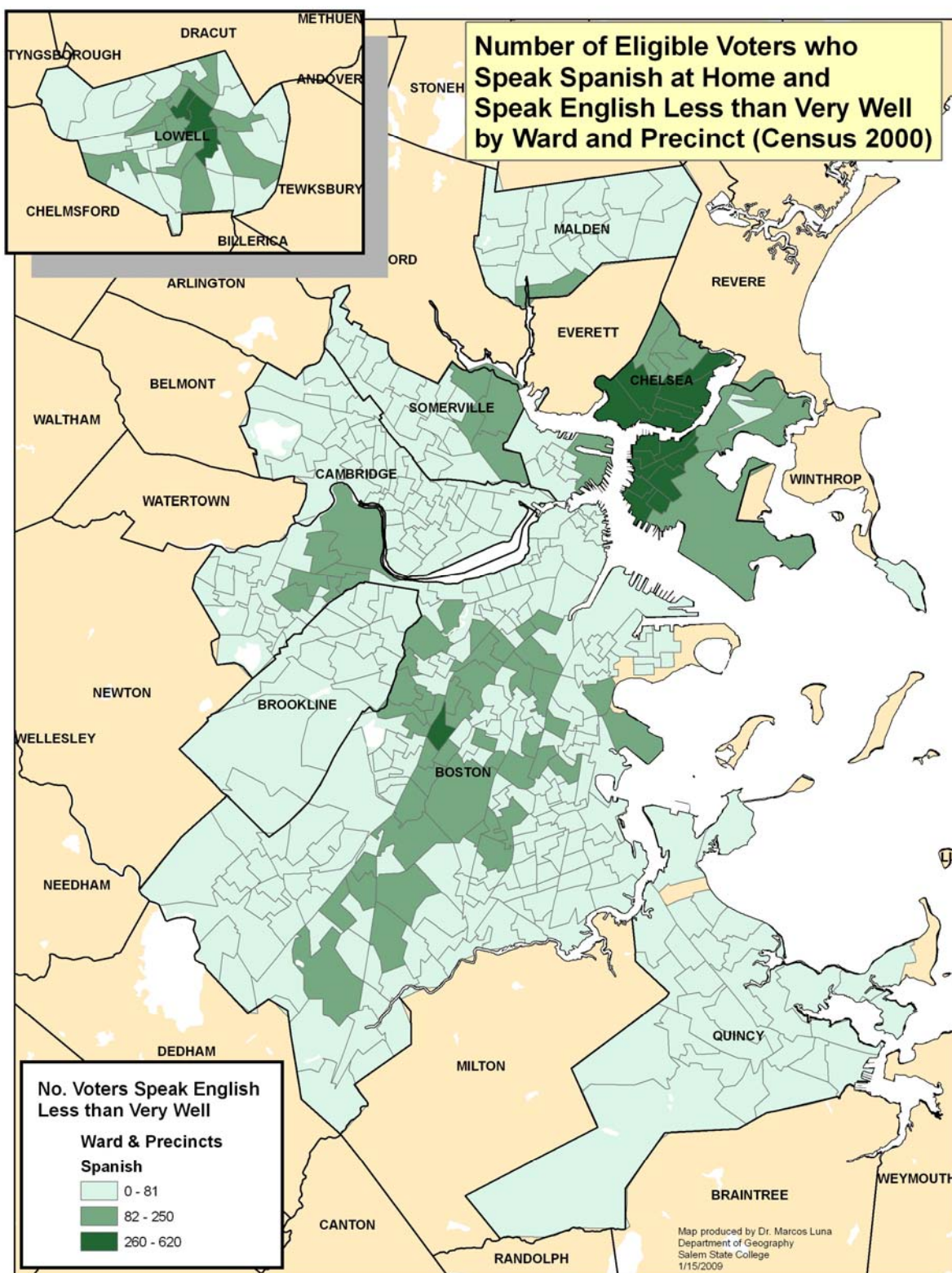


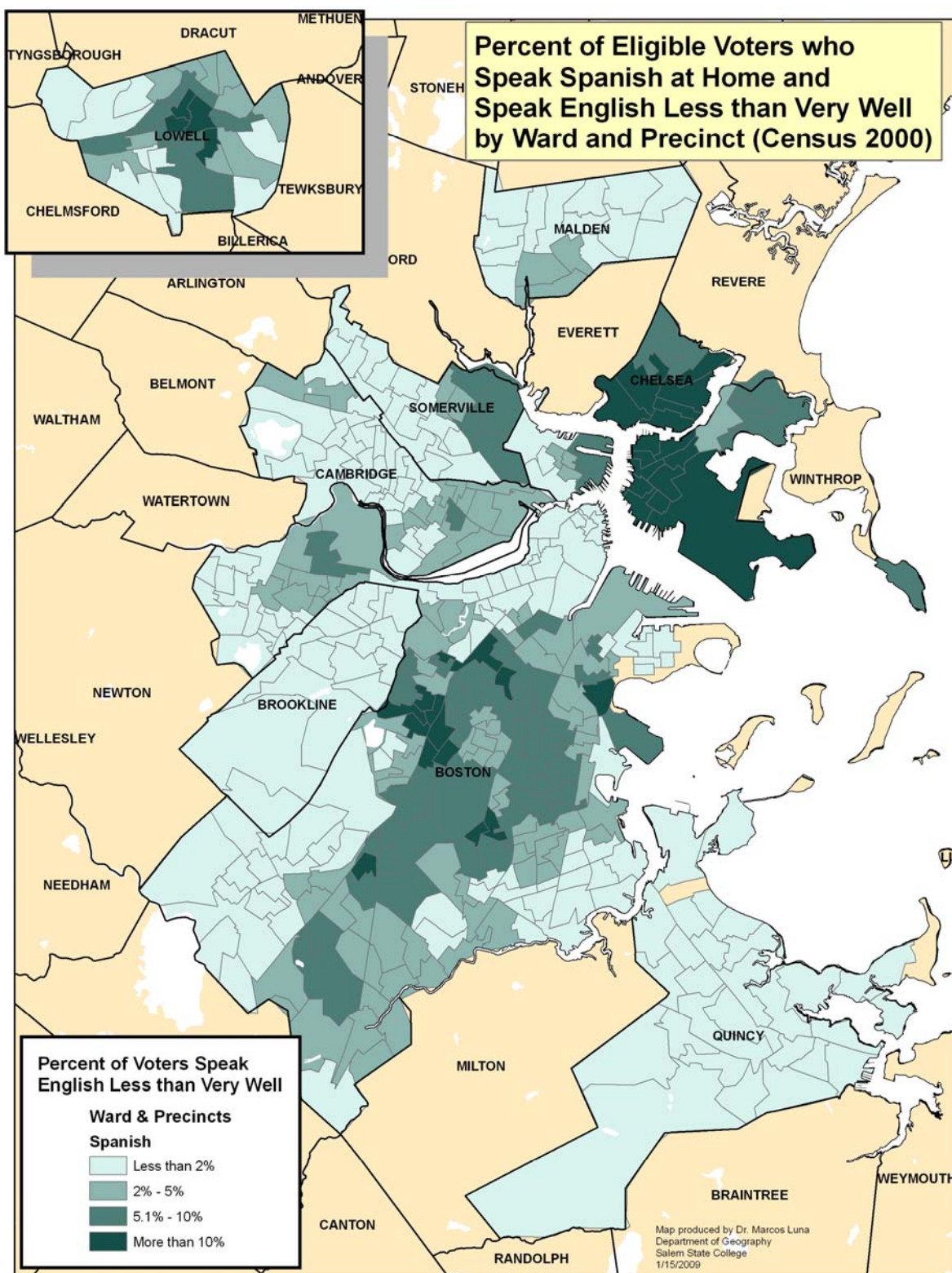


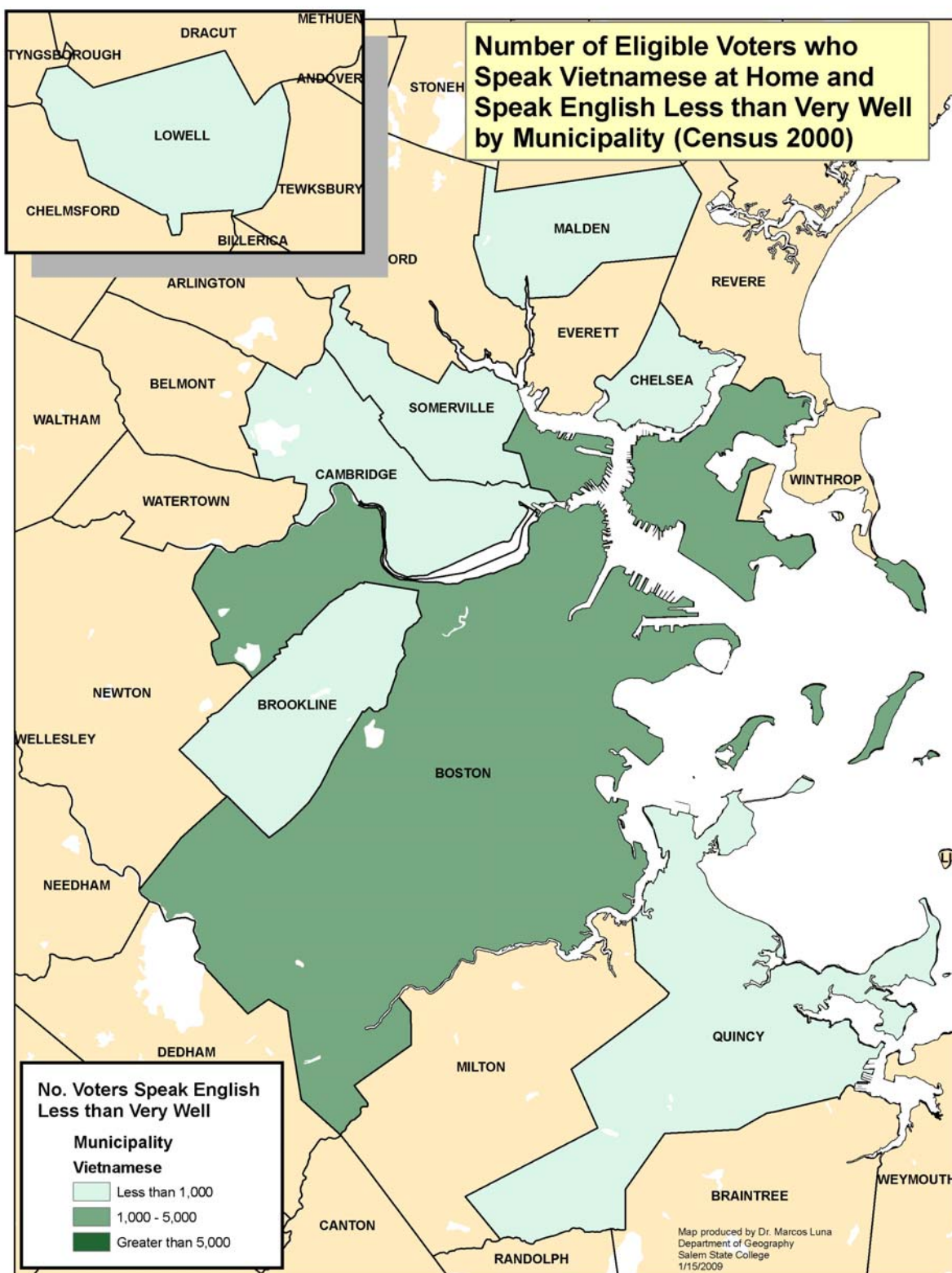


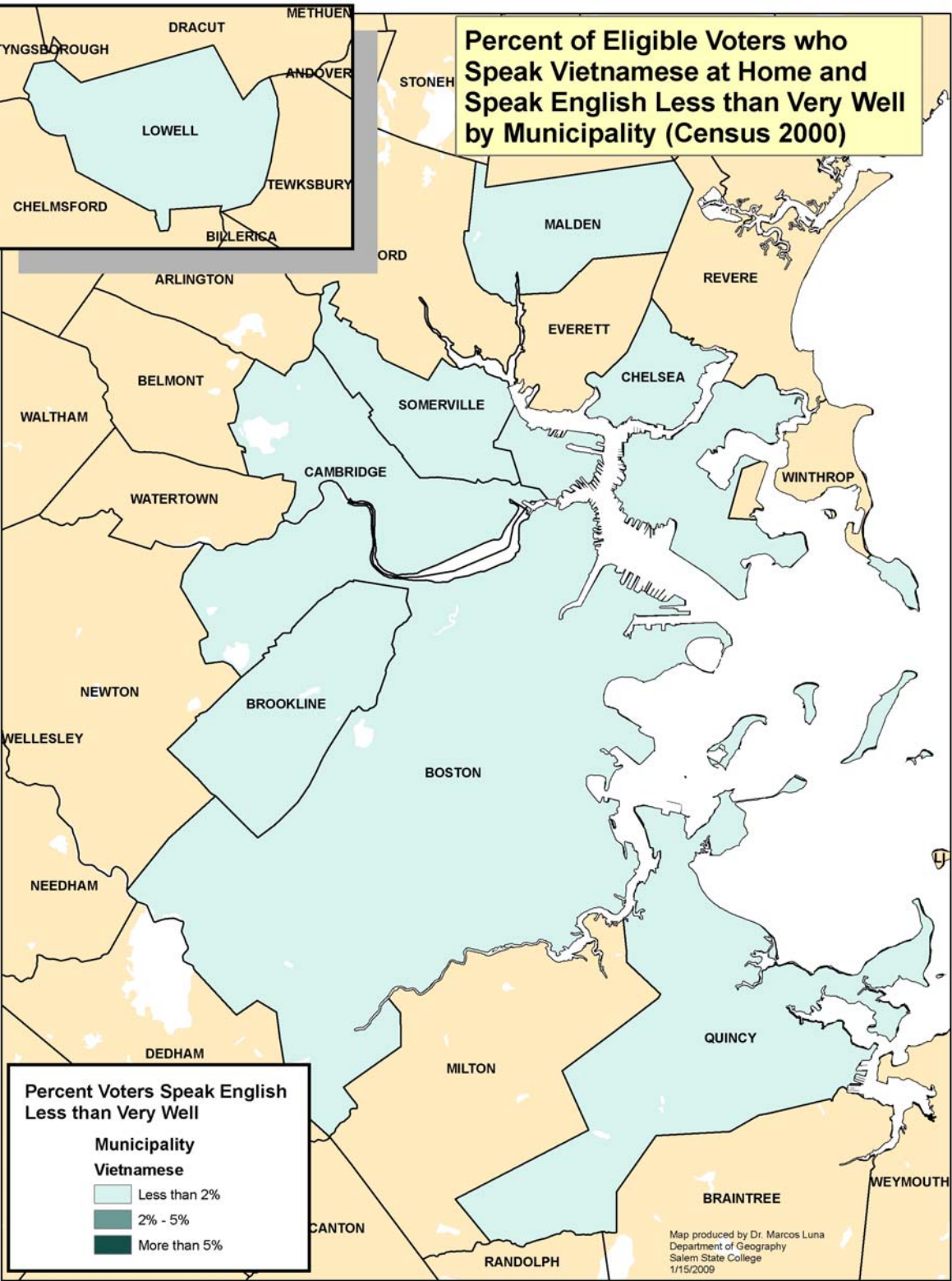


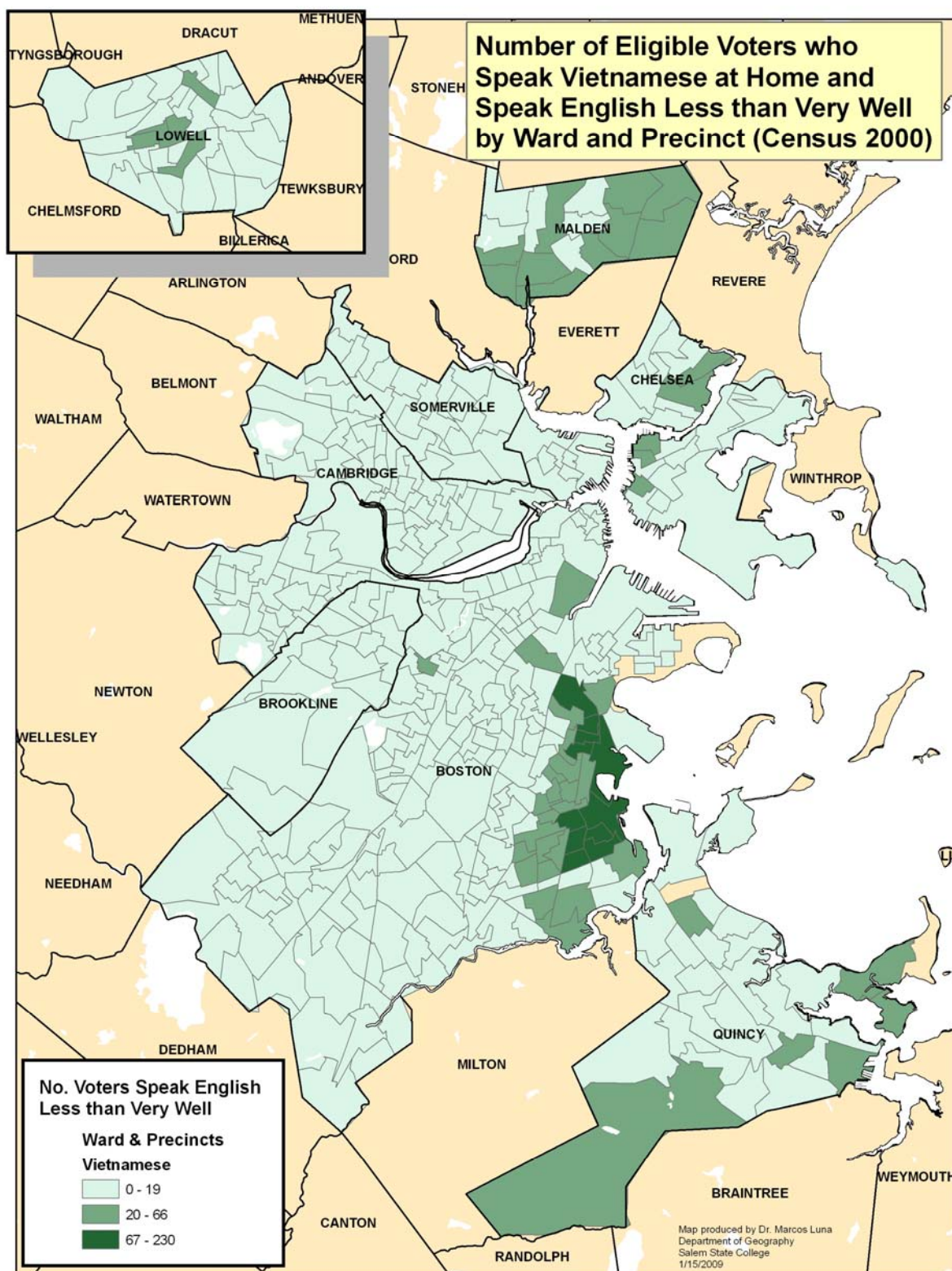


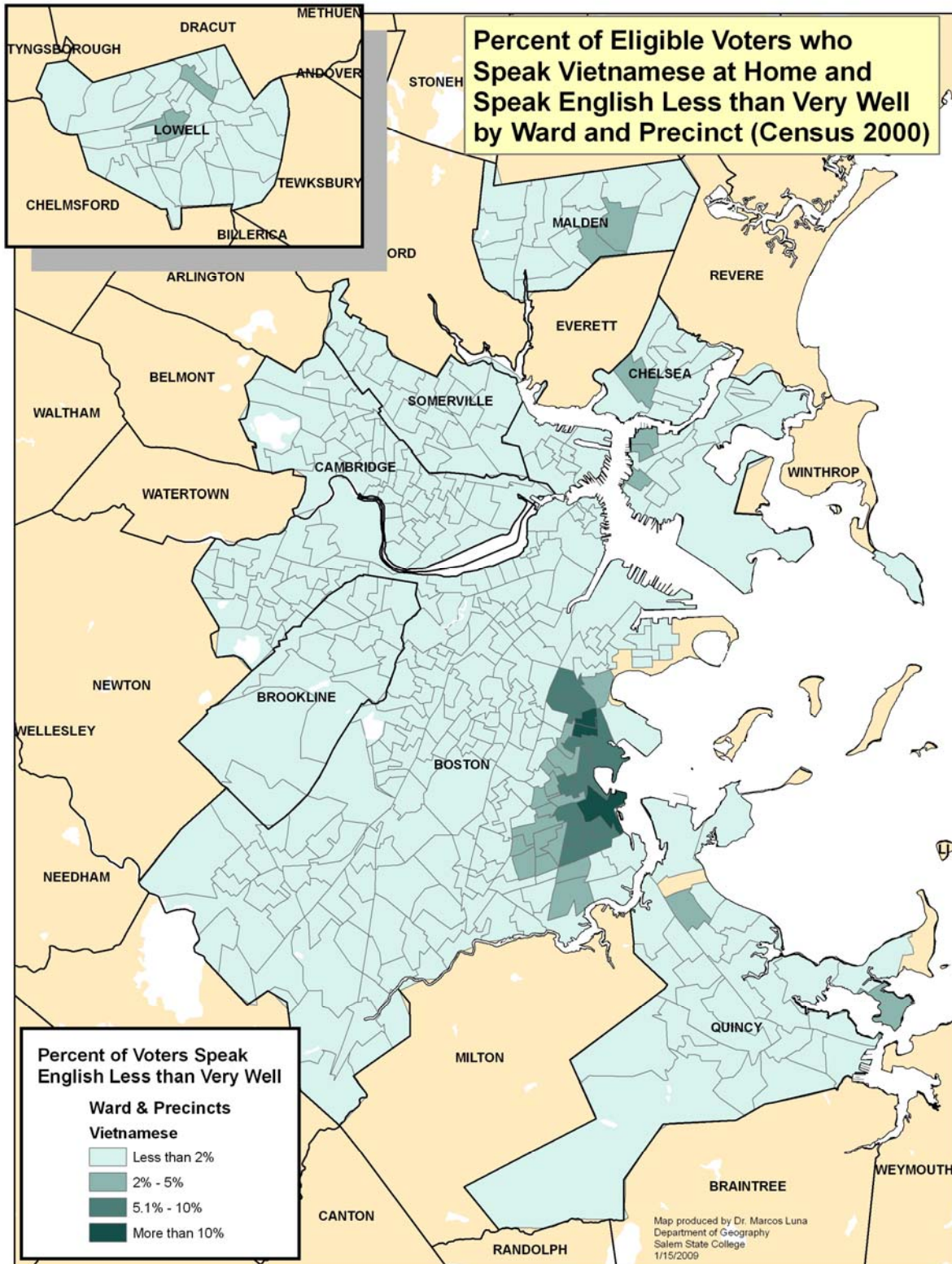












APPENDIX A

A. Detailed Description of Methodology to Estimate Limited English Eligible Voters by Voting Precinct

Although the U.S. Census Bureau compiles data on languages, language abilities, citizenship, and age, the data is not all available down to Census Tract levels, and is not available in a form immediately useful for this study. We were, however, able to use relevant data from three Census 2000 tables to estimate targeted-language populations by voting precinct.

The process involved calculating by Census Tract the percentages of speakers of three language *groups* who speak English less than “very well” from one table, using those percentages to estimate the number of voting-age limited-English speakers of the targeted languages (from a second table), and then applying a city-wide race/ethnicity citizenship percentage (from a third table) to each Tract's results. GIS software was then used to apportion each Tract's numbers to the proper voting Precincts. The process is described in more detail below.

First, we used Census 2000 Summary File 3 table P19: “Age by Language Spoken At Home by Ability to Speak English for the Population 5 years and over” by Census Tract. It has fields of interest, for speakers of languages in the “Spanish,” “Asian-Pacific,” and “Indo-European” language groups.

Targeted Individual Languages, distributed by language group

Language Group	Spanish	Asian-Pacific	Indo-European
Individual Language by language group	Spanish	Vietnamese, Chinese Khmer	Russian, Portuguese, Haitian-Creole

Based on: Table 23b Massachusetts -- Ability to Speak English by Language Spoken at Home for the Population 18 Years and Over: 2000, U.S. Census 2000

To calculate the percentage of speakers of each language group who do not speak English “very well”, we used the following fields:

Population age 18-64 who speak a language in that group (*referred as A below*)

Population age 18-64 in the above total who also speak English "very well" (*referred as B*)

Population age 65+ who speak a language in that group (*referred as C*)

Population age 65+ in the above total who also speak English "very well" (*referred as D*)

$$\frac{(A + C) - (B + D)}{(A + C)}$$

For example, all adult Asian-Pacific language speakers, minus those who speak English “very well”, divided by the total number of adult Asian-Pacific languages speakers. The other language groups (Spanish, and Indo-European) were calculated in the same way, using the corresponding fields that the table (P19) provides for those language groups.

Now that we had the percentage of language *group* speakers who do not speak English "very well", we used Census 2000 Summary File 3 table PCT10: “Age By Language Spoken At Home for the Population 5 years and over” by Census Tract on *individual* languages to estimate the number of speakers of an individual language who do not speak English “very well”. This table has numbers of native speakers of many languages, grouped by age.

Multiplying the number of adult speakers (18 years and over) of a particular language by the previously calculated percentage of adult speakers in a language group who do not speak English “very well” gave us an estimation of the number of speakers of each language that might need translated voting ballots. For instance, the number of people 18 years and older who speak Chinese at home (available in the table PCT10) was multiplied by the percentage of people who speak any of the Asian-Pacific languages at home and do not speak English “very well” (calculated in table P19). The same percentage was used for Vietnamese and Khmer, which are also Asian-Pacific languages. Russian, Haitian-Creole, and Portuguese are part of the Indo-European language group and that percentage was used. According to the Census Bureau, Spanish is a separate language category and that percentage was applied to the Spanish speakers.

The next step was to estimate the proportion of those people who are citizens (either U.S. natives or naturalized citizens), and thus eligible to vote. For that, we calculated the citizenship percentage of adults in each town for people of individual ethnic or ancestry population groups, such as Chinese, using the Census 2000 Summary File 4 Table PCT44: “Sex by Age by Citizenship” by city/town. Separate tables were generated by the U.S. Census for each population group: Chinese alone, Vietnamese alone, Cambodians alone, Hispanic (all races), Russian, Haitian, Portuguese, Cape Verdean, and Brazilian. We used city/town level totals so that we would have numbers large enough to use to calculate percentages. The necessary fields included:

- Number of native U.S.-born males age 18+
- Number of naturalized U.S. citizens males age 18+
- Number of native U.S.-born females age 18+
- Number of naturalized U.S. citizens females age 18+
- Total males age 18+
- Total females age 18+

The percentage of voting-age citizens in any one group is equal to:

$$\frac{(\text{Males US native}) + (\text{Males US naturalized}) + (\text{Females US native}) + (\text{Females US naturalized})}{(\text{All Males}) + (\text{All Females})}$$

The resulting values represented the targeted data by Census Tract. The final step was to apportion these Census Tract level numbers to voting Precincts. Census Tracts and voting Precincts do not encompass equivalent areas and their boundaries do not coincide precisely. The process of apportioning Census Tract level numbers to voting Precincts was accomplished through geographic overlay using ArcMap 9.3, a Geographic Information System (GIS). A feature class or map layer representing Census Tracts (MassGIS file census2000_poly.shp) was overlaid with a separate feature class or layer representing voting Precincts (Census cartographic boundary file vt25_00.shp). The Intersect of these two feature classes produced a new feature

class or layer consisting of the geometric intersection of Census Tract polygons and voting Precinct polygons that share the same area. Attributes from both feature classes were carried over to the new polygons in the new, intersected feature class. Because the new polygons differed in size and shape from their parent polygons, the areas of the new polygons were calculated and divided by the original areas of their parent Census Tract polygons in order to determine the percentage of parent Census Tract that each new polygon represented. The numbers of Limited English Speaking Eligible Voters were then apportioned to each polygon based on the percentage of area that the new polygon represented. The intersected polygons were then Dissolved, re-aggregated as voting Precincts and the numbers of eligible voters summed.

For example, imagine that the area encompassed by Census Tract 001 overlaps the same area as Precinct A and Precinct B, and each Precinct is exactly one-half the area of Census Tract 001. Census Tract 001 contains 100 individuals of interest. Knowing this, we can then assign 50 individuals from Census Tract 001 to Precinct A and the remaining 50 individuals to Precinct B. The process assumes that individuals are spread equally across each Census Tract.

APPENDIX B

B. Detailed Description of Methodology to Estimate Limited English Eligible Voters by Municipality

In order to calculate numbers of Limited English Eligible Voters for municipalities we took advantage of state level estimates made by the 2000 Census. Table PHC-T-37 “Ability to Speak English by Language Spoken at Home for the Population 18 Years and Over” provides numbers for 34 specific languages, including all seven of our target languages, for the state as a whole.

To calculate the percentage of speakers of each language who do not speak English “very well” for the state, we used the following fields:

Population age 18+ who speak a language (*referred as A below*)

Population age 18+ who also speak English “very well” (*referred as B*)

$$\frac{A - B}{A}$$

For example, all Chinese speakers 18 years and older, minus Chinese speakers 18 years and older who speak English “very well,” divided by the total number of Chinese speakers 18 years and older. The other languages of interest were calculated in the same way. For each language, this calculation provided the percentage of speakers of that language who speak English less than “very well” for the state as a whole.

Using Census 2000 Summary File 3 table PCT10: “Age By Language Spoken At Home for the Population 5 years and over,” we multiplied the number of adult speakers (18 years and over) of a particular language in a municipality by the previously calculated statewide percentage of adult speakers in a language group who do not speak English “very well” to derive an estimation of the number of speakers of each language who are 18 years and older and speak English less than very well. For instance, the number of people 18 years and older who speak Chinese at home in a given municipality (available in the table PCT10) was multiplied by the

percentage of people in the state 18 years and old who speak Chinese at home and do not speak English “very well” (derived from table PHC-T-37). The same percentage was used for Chinese speakers in each municipality.

The final step was to estimate the proportion of those people who are citizens (either U.S. natives or naturalized citizens), and thus eligible to vote. For that, we calculated the citizenship percentage of adults in each town for people of individual ethnic or ancestry population groups, such as Chinese, using the Census 2000 Summary File 4 Table PCT44: “Sex by Age by Citizenship” by city/town. Separate tables were generated by the U.S. Census for each population group: Chinese alone, Vietnamese alone, Cambodians alone, Hispanic (all races), Russian, Haitian, Portuguese, Cape Verdean, and Brazilian. We used city/town level totals so that we would have numbers large enough to use to calculate percentages. The necessary fields included:

Number of native U.S.-born males age 18+

Number of naturalized U.S. citizens males age 18+

Number of native U.S.-born females age 18+

Number of naturalized U.S. citizens females age 18+

Total males age 18+

Total females age 18+

The percentage of voting-age citizens in any one group is equal to:

$$\frac{(\text{Males US native}) + (\text{Males US naturalized}) + (\text{Females US native}) + (\text{Females US naturalized})}{(\text{All Males}) + (\text{All Females})}$$

These citizenship percentages were then multiplied by the numbers of adults 18 years and older who speak English less than very well in each language of interest by municipality. The resulting values represented the targeted data by municipality.