
An Economic and Spatial Baseline of Coastal Recreation in the North Central Coast of California

METHODS SECTION

Lead Authors:
(in alphabetical order)

Cheryl Chen
Chris LaFranchi
Kristen Sheeran
Charles Steinback

Contributing Authors:

Taylor Hesselgrave
Matthew Perry
Jon Bonkoski

April 23, 2013

This publication was supported by the State Coastal Conservancy, the State of California, and the California Department of Fish and Wildlife under Grant Agreement #09-015, through the California Sea Grant College Program. The views expressed herein do not necessarily reflect the views of any of those organizations.



1. Coastal Recreation Survey Methods

The North Central Coast (NCC) region coastal recreation survey was launched in February of 2011 after extensive testing to ensure the mapping component of the survey tool would capture quality spatial data at the appropriate scale and in a user-friendly manner. In an effort to capture seasonal variations in coastal use, we collected data on the respondent's most recent coastal trip, and deployed the survey in four survey "waves" over a one-year period.

Data collection was completed in December 2011, and the data were then subsequently analyzed and synthesized. In the survey, respondents were asked to recount details of their coastal visitation trips over the previous 12 months and of their last trip, including information about the number of trips taken, participation in recreational activities, the location of activities, and expenditures made. This section describes the survey and analysis methods, and the results are presented in the following section. The survey questions regarding coastal visitation and recreation use can be found in **Error! Reference source not found..**

Our study population ("sample frame") was defined as the total resident population over the age of 18 years of California counties within our study area (see Figure 1). We chose this study population as the primary goal of this study was to investigate coastal recreation which is commonly defined as day trips to the coast (outside of daily routine) that does not typically involve an overnight stay (although some coastal recreation trip by residents we captured did involve lodging, see trip expenditure section below). We differentiate this from coastal tourism which is often defined as involving overnight stays. However, establishing clear distinction between the two categories is somewhat difficult as they undoubtedly overlap making isolation difficult in survey efforts. Furthermore, the value of coastal real estate also may overlap with the value of coastal recreation in the case of coastal resident who may often recreate on the coast but do not incur any trip expenditures. One may argue that the value of this type of coastal use is captured in coastal real estate values where the individual resides.

The results of this study were designed to largely encompass the value of coastal recreation. It should be noted; however, the results provided here also encompass some coastal tourism and visitation values and conversely may not capture some of the value of coastal recreation stored in coastal real estate values.

These counties below were chosen as our study population as they are within a reasonable one-day's trip to the North Central Coast:

- Alameda
- Contra Costa
- Lake
- Marin
- Mendocino
- Napa
- Sacramento
- San Francisco
- San Mateo
- Santa Clara
- Santa Cruz
- Solano
- Sonoma

Table 1 displays the study population (6.9 million), the total population of the study area (9 million), and the population of the state of California (37.3 million).

Table 1. Number of survey respondents and 2010 population data

Area	Population
Study population (>18 yrs)	6,943,138
Study area total population	8,984,415
California state population	37,253,956

Source: Current study and data from the U.S. Census Bureau (2010)

Survey data were collected over four successive waves distributed across a calendar year to capture the seasonal variation in coastal use patterns. Table 2 displays the dates over which each wave was conducted and the respective number of respondents. Overall, the survey was completed by 5,079 respondents, however, there were more respondents in the first wave of the survey as we used this wave of the survey to determine an optimal sample size in each wave given the variance on the data collected and subsequently chose to reduce the sample size in subsequent survey waves. Table 3 displays the median survey length, ten minutes, and the total number of respondents that completed the mapping portion of the survey (3,018 which is approximately 60 percent of total respondents).

Table 2. Survey wave information

Survey wave	Wave dates	Respondents	%
Wave 1	Jan. 26–Feb. 23, 2011	1,996	39%
Wave 2	May 3–May 31, 2011	1,020	20%
Wave 3	Aug. 10–Sep. 7, 2011	1,028	20%
Wave 4	Nov. 1–Nov. 30, 2011	1,035	20%
TOTAL		5,079	100%

Source: Current study

Table 3. Survey length and completion

Total number of respondents	5,079
Median survey length (min)	10
# of respondents that completed the mapping portion	3,018

Source: Current study

We incorporated verbatim the US Census Bureau demographic survey questions into our survey. We then compared our findings to US Census demographic findings as an indication of how representative our survey sample is of the sample frame, see Table 4. Our survey aimed to be representative of the study area population, and while our data are relatively well matched with 2010 Census findings, there are two exceptions: 1) females are overrepresented; and, 2) Hispanic people are underrepresented.

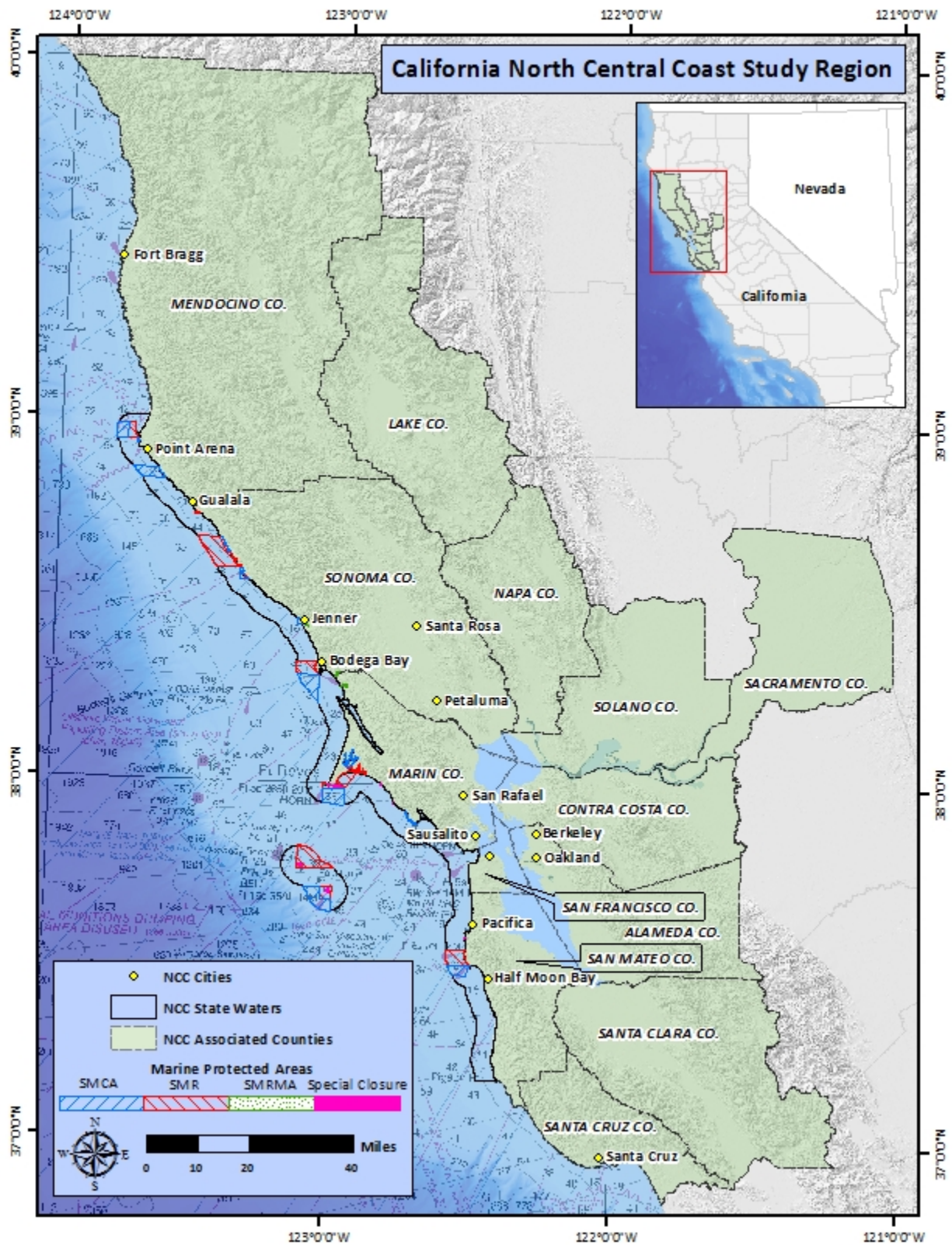
Table 4. Demographics of survey and study populations

Demographics	Survey respondents	Study area population
Male	34.1%	49.5%
Female	65.9%	50.5%
White, Non-Hispanic	63.8%	44.4%
Black, Non-Hispanic	3.5%	6.7%

Other, Non-Hispanic	21.8%	21.1%
Hispanic	8.4%	23.4%
2+ Races, Non-Hispanic	2.6%	3.6%

Source: Current study and data from the U.S. Census Bureau (2010)

Figure 1. North Central Coast Study Region



1.1. Coastal Recreation Survey Data Analysis Methods

To analyze the survey data, Knowledge Networks provided a post-stratification survey-weighting methodology to more closely align our survey sample representation with the study population's demographics. Once the survey was complete, Knowledge Networks applied data weights informed by demographic data to adjust each respondent's contribution to overall survey results. A data weight is effectively a multiplier that adjusts a given respondent's contribution to compensate for a variety of both planned and unexpected disproportionate effects. The aim of post-stratification survey-weighting is to adjust the weight given to individual sample data based on demographic characteristics so as to better reflect the population they are intended to represent.¹

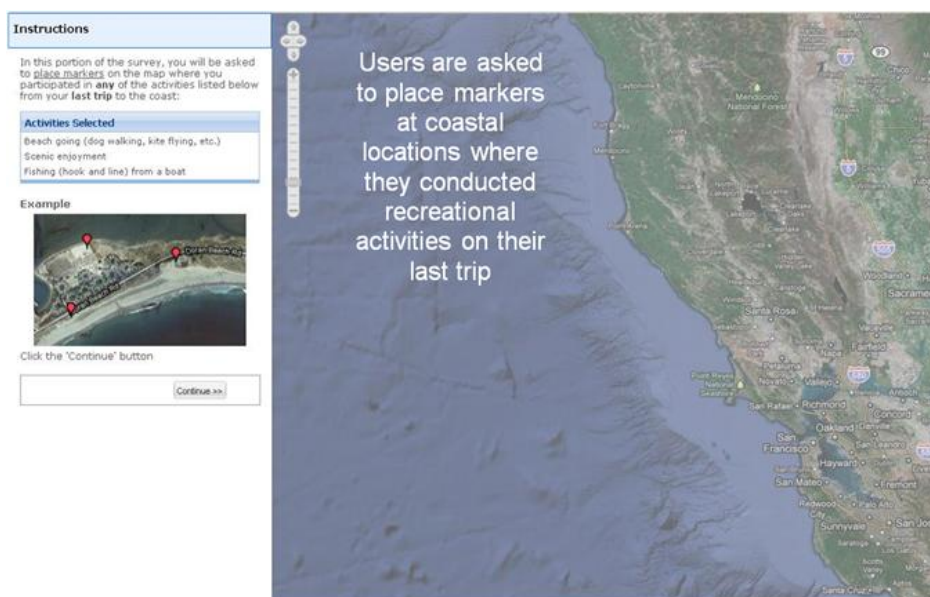
Once all respondents completed the survey, Knowledge Networks provided the post-stratification survey weights, and Ecotrust used the statistical software R to apply the weights and analyze the data, determining the weighted means as well as confidence intervals² as presented in the results in the report.

In addition to survey questions, respondents were asked to map the location where they conducted specific coastal recreation activities on their last trip. Details on this component of the survey effort and results are discussed below.

2. Spatial Data Analysis Methods

In addition to survey questions, respondents were asked to map the location of where they conducted specific coastal recreation activities on their last trip. To map locations, Ecotrust developed a sophisticated mapping tool utilizing Open OceanMap survey technology together with Google Maps (displayed in the screenshots below). The mapping tool was designed to be user-friendly and easily navigable. It required each respondent to zoom to a particular spatial scale in order to ensure that accurate and quality data were collected.

Figure 2. Screenshot of coastal recreation survey: Map interface

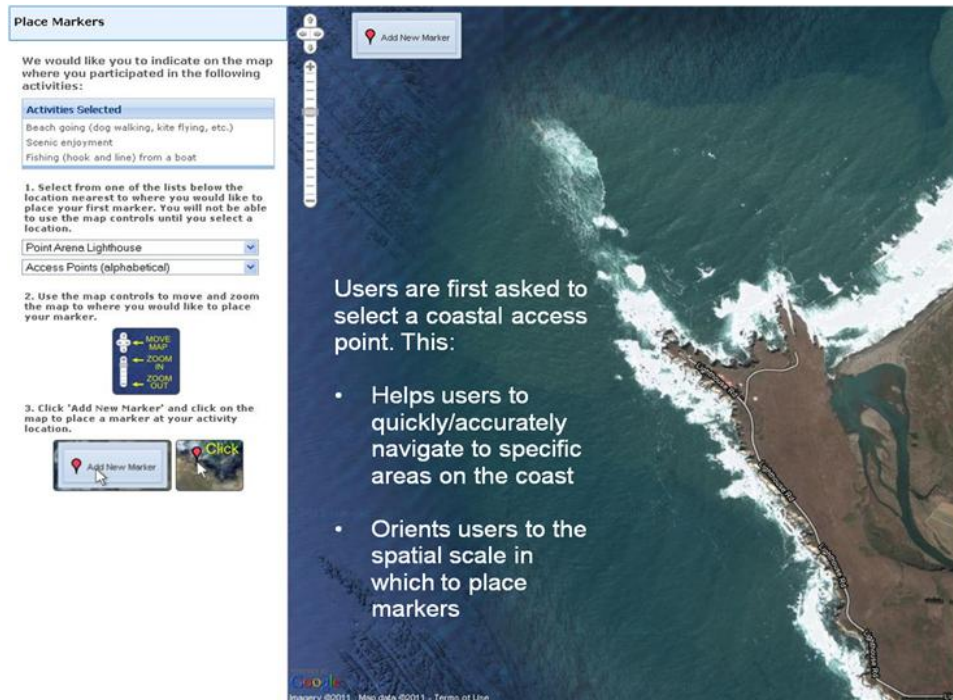


Source: Ecotrust

¹ More details about Knowledge Network's post-stratification survey-weighting methods can be found on the KN website: <http://www.knowledgenetworks.com/accuracy/summer2007/disogra.html>

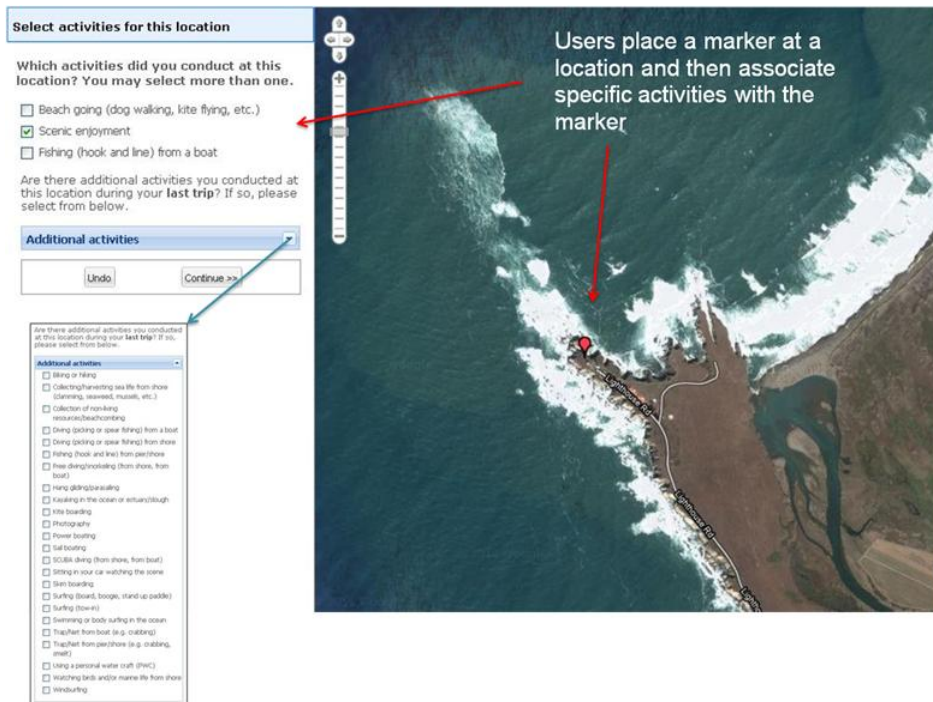
² Confidence intervals (CI) are statistical measures of variability which indicate the range of values in which the true value is likely to be given a specified probability, in this report confidence intervals are reported at 95 percent probability.

Figure 3. Screenshot of coastal recreation survey: Map navigation



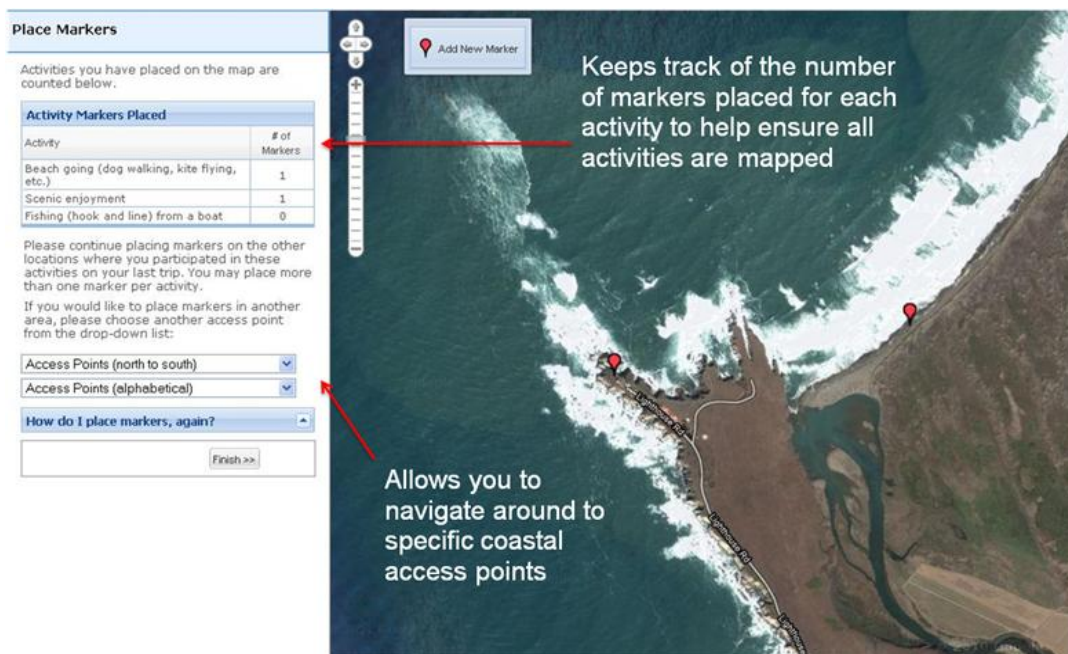
Source: Ecotrust

Figure 4. Screenshot of coastal recreation survey: Placing activity markers



Source: Ecotrust

Figure 5. Screenshot of coastal recreation survey: Tracking activity markers



Source: Ecotrust

As noted above the data were collected in four waves to capture seasonal variations in coastal recreation use patterns. The spatial data are a combined set across all four survey waves. The survey respondents provided information by placing a point or marker on a map and then indicated which activity or activities they conducted at each specific location on their last trip (Figure 4). There were a total of twenty-seven activities mapped, but only eight activities had a large enough sample (>100 point markers) to create a robust map product. Appendix B of this report contains maps depicting the spatial patterns of use (distribution and intensity of use) across the region for coastal recreation overall and for those select coastal recreation activities. Table 5 indicates the number of makers placed per activity per survey wave for all activities.

To create the spatial data, Ecotrust utilized a kernel density analysis in ArcGIS. The kernel analysis is a nonparametric statistical method for estimating probability densities from a set of point data. Conceptually, a smooth raster surface is fitted over each point. The surface value is highest at the location of the point and diminishes with increasing distance (i.e., search radius), eventually reaching zero. Based on previous experience conducting a similar analysis in Oregon and after conducting several tests, the kernel density analysis on all activities was given a search radius of one mile.

Weights given to the markers placed by individual respondents were also used and incorporated into the kernel density analysis. As discussed above, these weights were created by Knowledge Networks to align respondent demographics with study population demographics. The resulting dataset is a smooth raster surface depicting the intensity use or density of an activity. Table 5 displays the total number of activity markers that respondents placed for each activity in the mapping survey.

Table 5. Number of markers placed for each activity in mapping survey

Activity name	Number of activity markers placed				TOTAL
	Wave 1	Wave 2	Wave 3	Wave 4	
Scenic enjoyment	1,802	827	736	830	4,195
Photography	984	438	413	470	2,305
Beach going (dog-walking, kite-flying, etc.)	979	448	386	395	2,208
Watching birds and/or marine life from shore	637	319	283	339	1,578
Biking or hiking	634	300	233	314	1,481
Sitting in your car watching the scene	481	260	166	256	1,163
Collection of non-living resources/beachcombing	184	99	64	98	445
Swimming or body surfing in the ocean	56	38	23	20	137
Collecting/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	34	13	7	11	65
Fishing (hook and line) from pier/shore	15	9	8	20	52
Surfing (board, boogie, stand up paddle)	18	10	11	7	46
Kayaking in the ocean or estuary/slough	14	8	6	13	41
Sailboating	7	12	12	5	36
Fishing (hook and line) from a boat	10	6	8	9	33
Powerboating	7	6	7	9	29
Trap/Net from pier/shore (e.g. crabbing, smelt)	10	7	3	3	23
Diving (picking or spear fishing) from shore	6	6	1	5	18
Free-diving/snorkeling (from shore, from boat)	5	6	4	2	17
Skimboarding	7	5	1	1	14
Using a personal water craft (PWC)	7	5	1		13
Trap/Net from boat (e.g. crabbing)	6	4	-	2	12
Hang gliding/parasailing	3	7	1	-	11
Diving (picking or spear fishing) from a boat	2	4	2	-	8
Kiteboarding	2	4	1	1	8
Scuba diving (from shore, from boat)	1	4	1	2	8
Windsurfing	2	4	-	-	6
Surfing (tow-in)	-	3	-	-	3
TOTAL NUMBER OF ACTIVITY MARKERS	5,913	2,852	2,378	2,812	13,955

Source: Current study