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# Potential Effects of a Scenario Earthquake on the Economy of Southern California: Baseline County-Level Migration Characteristics and Trends 1995–2000 and 2001–2010

San Bernardino

Los Angeles

Orange

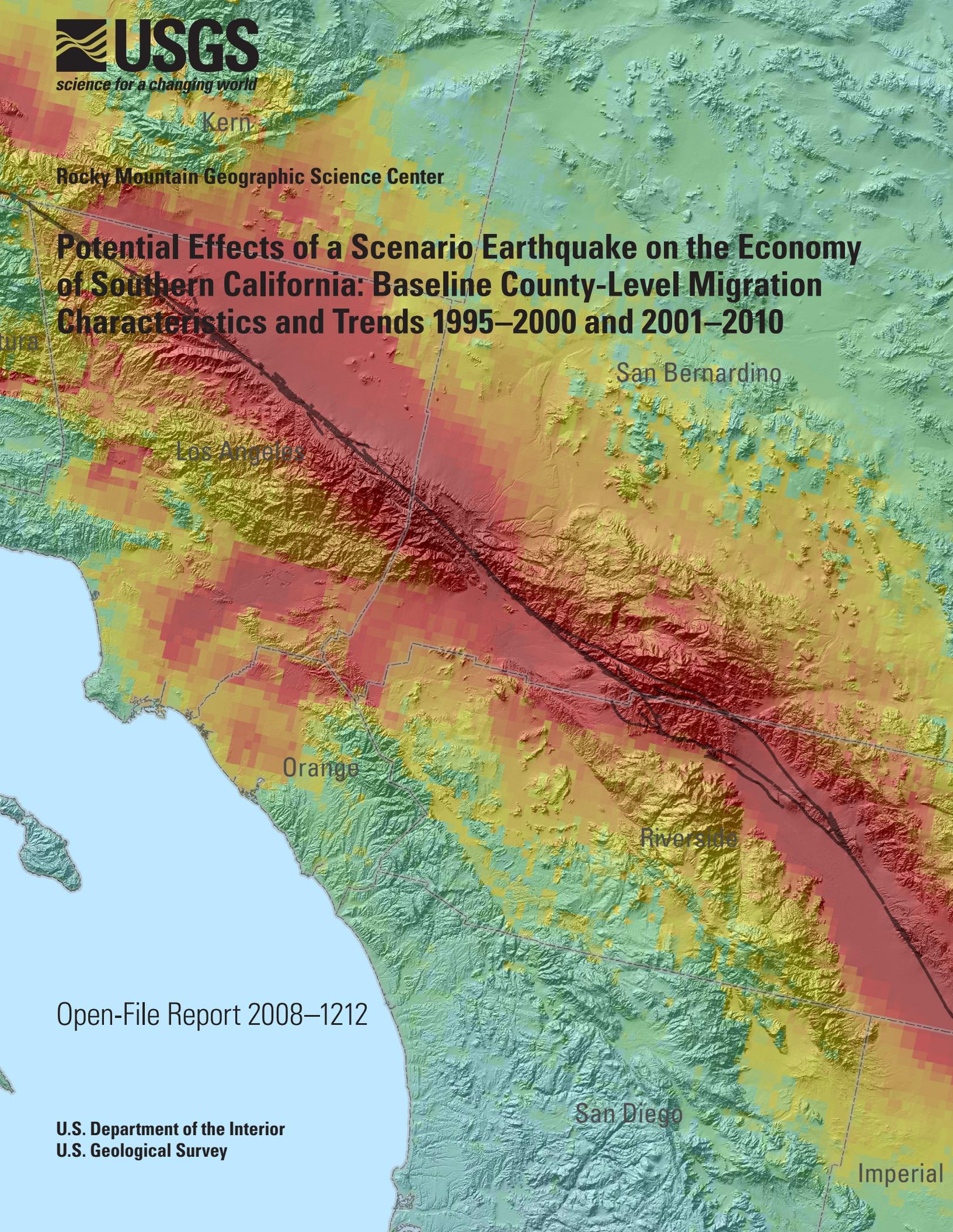
Riverside

Open-File Report 2008–1212

U.S. Department of the Interior  
U.S. Geological Survey

San Diego

Imperial



**FRONT COVER**—Instrumental Intensity for the simulated magnitude 7.8 ShakeOut Scenario earthquake overlaying a shaded-relief terrain map for a portion of the eight-county Southern California regional study area. Lowest intensities are in blue while highest intensities are in red. A portion of the San Andreas Fault is symbolized in black. California county boundaries are illustrated using a dashed-line symbology and county names are annotated in gray.

**Rocky Mountain Geographic Science Center**

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By Benson C. Sherrouse and David J. Hester

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**U.S. Department of the Interior  
U.S. Geological Survey**

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# Potential Effects of a Scenario Earthquake on the Economy of Southern California: Baseline County-Level Migration Characteristics and Trends 1995–2000 and 2001–2010

By Benson C. Sherrouse and David J. Hester

## Introduction

The Multi-Hazards Demonstration Project (MHDP) is a collaboration between the U.S. Geological Survey (USGS) and various partners from the public and private sectors and academia, meant to improve Southern California's resiliency to natural hazards (Jones and others, 2007). In support of the MHDP objectives, the ShakeOut Scenario was developed. It describes a magnitude 7.8 (M7.8) earthquake along the southernmost 300 kilometers (200 miles) of the San Andreas Fault, identified by geoscientists as a plausible event that will cause moderate to strong shaking over much of the eight-county (Imperial, Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura) Southern California region (Jones and others, 2008). This report uses historical, estimated, and projected population data from several Federal and State data sources to estimate baseline characteristics and trends of the region's population migration (that is, changes in a person's place of residence over time). The analysis characterizes migration by various demographic, economic, family, and household variables for the period 1995–2000. It also uses existing estimates (beginning in 2001) of the three components of population change—births, deaths, and migration—to extrapolate near-term projections of county-level migration trends through 2010. The 2010 date was chosen to provide baseline projections corresponding to a two-year recovery period following the November 2008 date that was selected for the occurrence of the ShakeOut Scenario earthquake. These baseline characteristics and projections shall assist with evaluating the effects of inflow and outflow migration trends for alternative futures in which the simulated M7.8 earthquake either does or does not occur and the impact of the event on housing and jobs, as well as community composition and regional economy changes based on dispersion of intellectual, physical, economic, and cultural capital.

## Data Sources

Historical and projected population data were obtained from the U.S. Census Bureau and the State of California's Department of Finance. U.S. Census data regarding the characteristics of total population migration from 1995 to 2000 were obtained from the Census 2000 Migration Data DVD (U.S. Census Bureau, 2003b). These data were derived from answers to the question asking "residence 5 years ago" on the Census 2000 long form. Where available, these data were supplemented with annual inflow migration data from the 2001 through 2005 American Community Survey (U.S. Census Bureau, 2001, 2002, 2003a, 2004, and 2005). Several reports from the Demographic Research Unit of the State of California's Department of Finance provided annual estimates and projections of births, deaths, and migration for total population and population by race for the period 2001–2010 (State of California, 2006a, 2006b, 2006c, and 2007). The availability of projections for the entire period, however, varied among the population components and characteristics.

## Methodology

### Migration Characteristics: 1995–2000, 2004, and 2005

The total county-level domestic inflows, outflows, and net migration for the years 1995–2000 were provided on the Census 2000 Migration Data DVD. Also provided were data for international inflows. The net migration data were adjusted to include these international inflows. This adjustment was necessary so that a substantial proportion of each county's inflows could be accounted for in the analysis. This also allowed for a more direct comparison between the Census and State of California net migration estimates since the State methodology includes international inflows. The total

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1995–2000 inflows, outflows, and net migration flows were tabulated and graphically summarized by county for the following characteristics:

- Age,
- Educational attainment,
- Hispanic origin,
- Household income,
- Household type,
- Housing tenure,
- Industry,
- Labor force status,
- Marital status,
- Occupation,
- Poverty status,
- Race,
- Sex, and
- Total population.

Annual migration inflows by selected population characteristics were also available at the county level from the 2004 and 2005 American Community Surveys (U.S. Census Bureau, 2004, 2005). Data covering migration outflows and net migration were not available. In addition, Imperial County data were not available from the American Community Survey (ACS) as its total population is under 250,000. These ACS data were also tabulated and graphically summarized along with the corresponding migration inflow data from the Census 2000 Migration Data DVD. For comparison between the five-year data totals included in the DVD and the single-year totals of the ACS, the average annual inflow was calculated from the five-year totals. The summarized population characteristics include:

- Age,
- Educational attainment,
- Household type,
- Housing tenure,
- Marital status,
- Poverty status,
- Sex, and
- Total income.

### Migration Trends: 2001–2010

The change in population (POP) over a given time period can be described as:

$$\text{POP}_{\text{current}} = \text{POP}_{\text{previous}} + \text{NATURAL INCREASE} + \text{NET MIGRATION}$$

Natural increase can be further defined as:

$$\text{NATURAL INCREASE} = \text{BIRTHS} - \text{DEATHS}$$

Net migration can be further defined as:

$$\text{NET MIGRATION} = \text{INFLOWS} - \text{OUTFLOWS}$$

The natural increase can, of course, be a natural decrease if deaths exceed births. Similarly, the net migration will become a negative value if outflows exceed inflows. Regardless of its direction, the total change is a combination of the natural change and the net migration. If estimates of births and deaths are provided, an estimate of net migration can be determined because it represents the residual change after subtracting the natural change from the total change. For the analysis, this approach is taken to arrive at projections of county-level net migration through the year 2010. Migration is the most difficult of the population change components to estimate because short-term economic changes can lead to substantial variations in the patterns and trends of migration (Klosterman, 1990). For the projections to 2010, we avoid these difficulties by relying on existing estimates and projections of total population, births, and deaths, along with basic assumptions that recent birth and death rates will continue similarly through 2010.

The State of California data included county-level projections of total population and births through 2010. Estimates of deaths and net migration were also provided through 2006. To derive net migration projections for 2007–2010, it was first necessary to calculate the total population change and the natural increase for each of these years. First, the total population change for each of these years was calculated from the State of California projections. A crude annual mortality rate for each year from 2000 to 2006 was then calculated as the estimated number of deaths each year divided by the total population in the same year. These rates were then averaged, and this average rate was multiplied by the total population projections for each year from 2007 to 2010 to arrive at the projected number of deaths for each of these years. The projected deaths were then subtracted from the given births for the same year to obtain the annual natural increase in population. As described previously, by subtracting the natural increase from the total population change, an estimate of net migration for each year is obtained.

For all counties but Imperial, the ACS provided data regarding the annual migration inflows for 2001 through 2005. The annual inflow rate for each of these years was calculated by dividing the annual amount of inflow by the total population for the corresponding year. These rates were averaged, and

this average rate was applied to total population estimates and projections for each year from 2006 to 2010 to arrive at the projected amount of inflows for each of these years. These projected inflows were subtracted from net migration to produce estimates of migration outflows through 2010. County-level net migration, inflows, and outflows for the years 2001–2010 were tabulated and graphically summarized.

Population data disaggregated by race were also available from the State of California. While total population projections were available through 2010, estimates of births and deaths were only included through 2004. Similar to the methods for total population, estimates of net migration were derived through 2010. However, it was necessary to also calculate crude annual birth rates in order to compute estimates of births for the years 2005–2010, in addition to the crude annual mortality rate used previously. Also, no racially disaggregated migration inflow data were available to further break down net migration projections into inflows and outflows. County-level net migration data by race for the years 2001–2010 were also tabulated and graphically summarized.

## Baseline Migration Characteristics and Trends

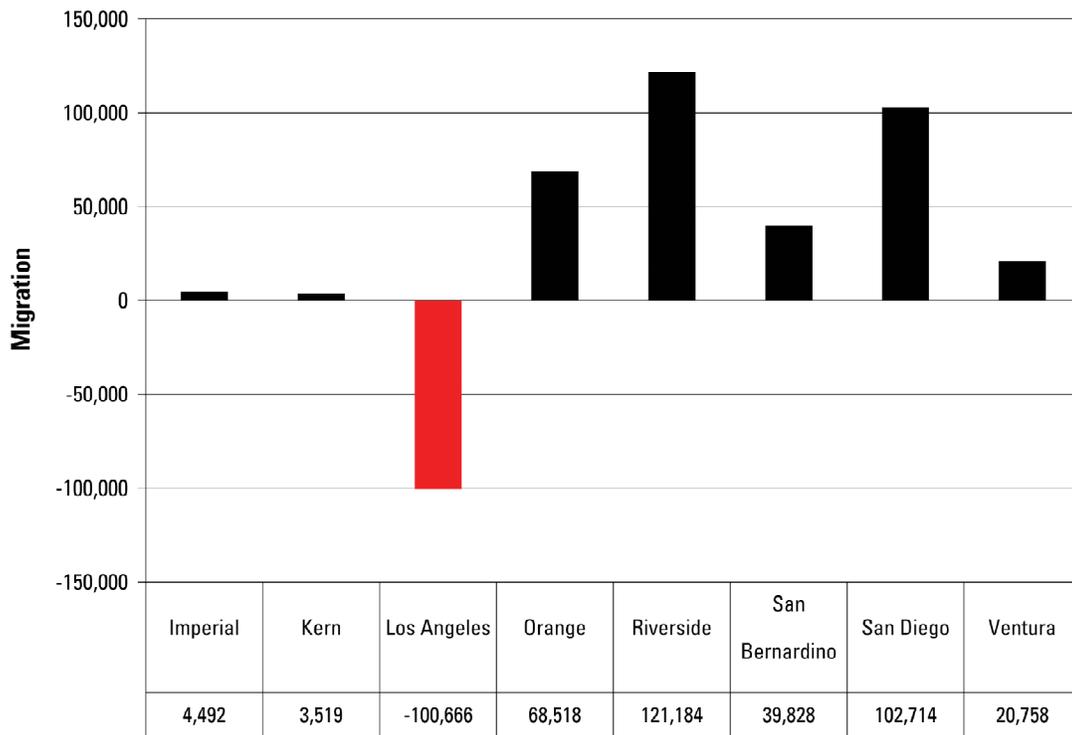
U.S. Census data from 2000 show that all Southern California counties except for Los Angeles experienced

positive net migration between 1995 and 2000 (fig. 1). Riverside County saw the highest level of net migration during this period, exceeding 120,000. The inflow and outflow components of net migration are also illustrated (figs. 2–3). Los Angeles County experienced, by far, the largest migration inflows and outflows; that is, over 1 million people in either direction.

Population characteristics for these 1995–2000 migration flows along with 2004 and 2005 data for selected characteristics are included in separate files listed in the appendix.

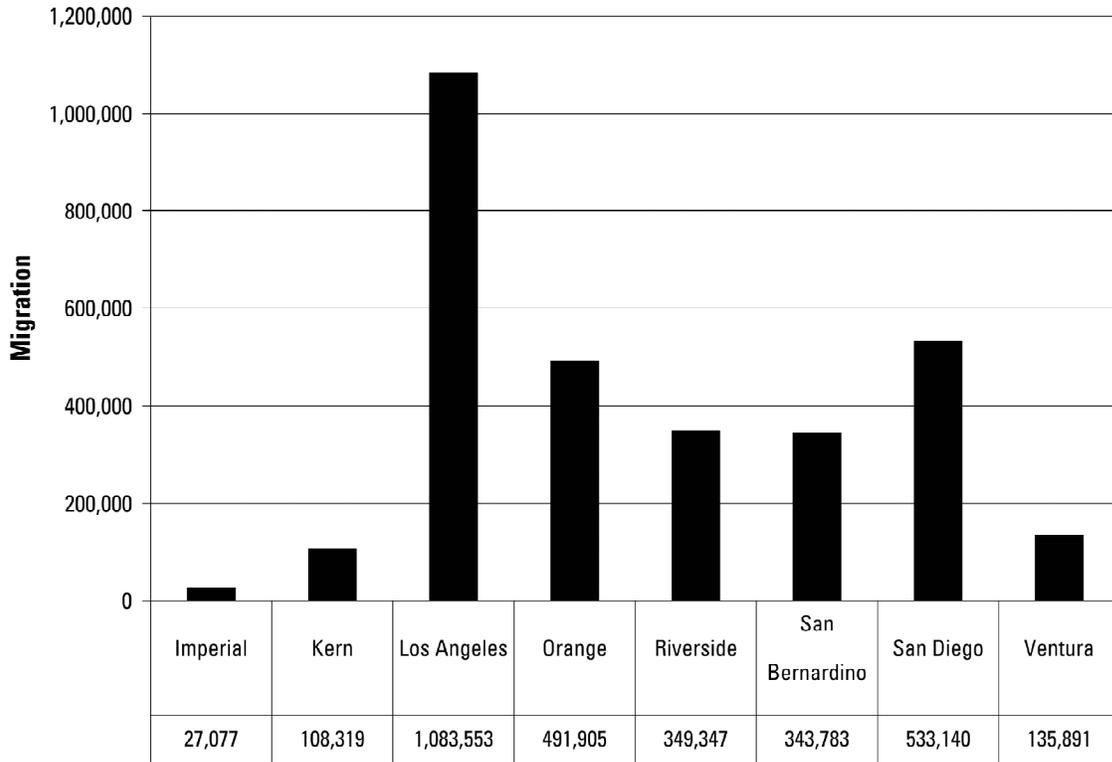
The 2001–2010 county-level migration trends reflect inflows and outflows arriving from and leaving for other areas both within and outside the region. These trends indicate negative net migration continuing for Los Angeles County, with Riverside County experiencing the greatest total positive net migration of all eight counties in the Southern California region (fig. 4). Riverside County consistently outpaces all other Southern California counties except Los Angeles County in migration inflows (fig. 5), and its migration outflows gradually increase to eventually surpass both San Bernardino and Orange Counties (fig. 6).

The racial composition of Riverside County’s net migration is primarily Hispanic and White (fig. 7). Net migration trends by race for the other Southern California counties are included in a separate file listed in the appendix.

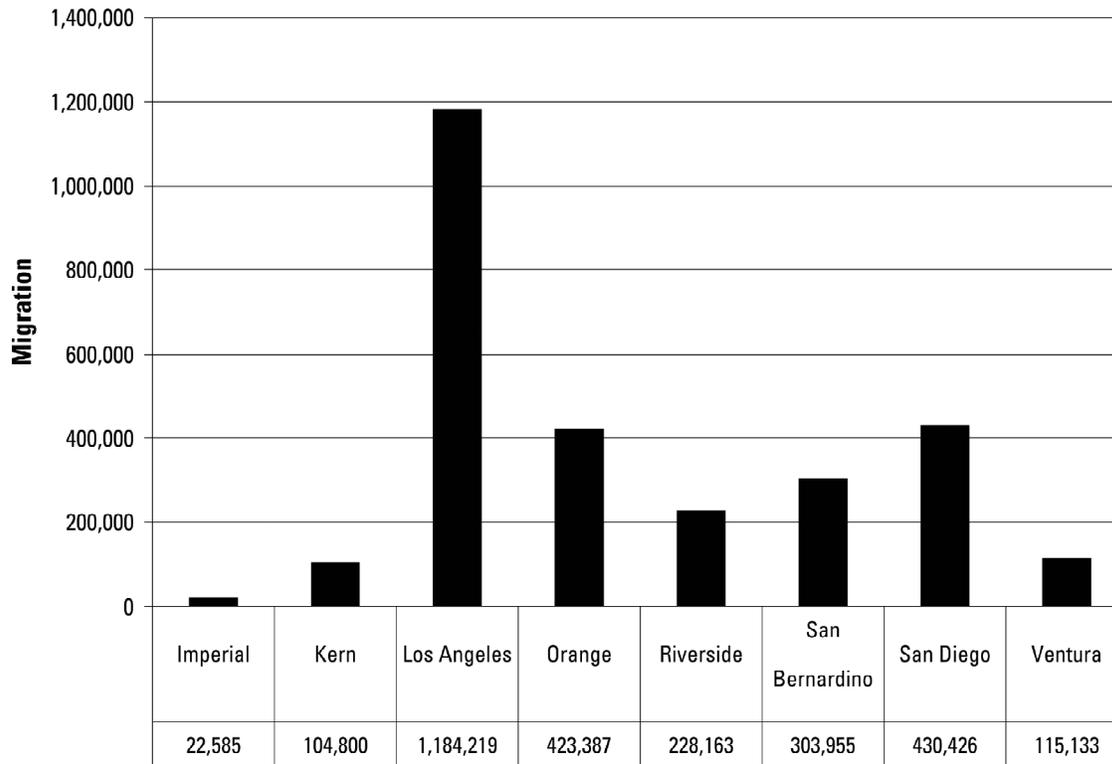


**Figure 1.** Southern California net migration by county, 1995–2000. Los Angeles County experienced the only negative net migration, while Riverside County experienced the highest net migration.

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**Figure 2.** Migration inflows by county, 1995–2000. Los Angeles County exceeds 1 million people.



**Figure 3.** Migration outflows by county, 1995–2000. Los Angeles County exceeds 1.1 million people.

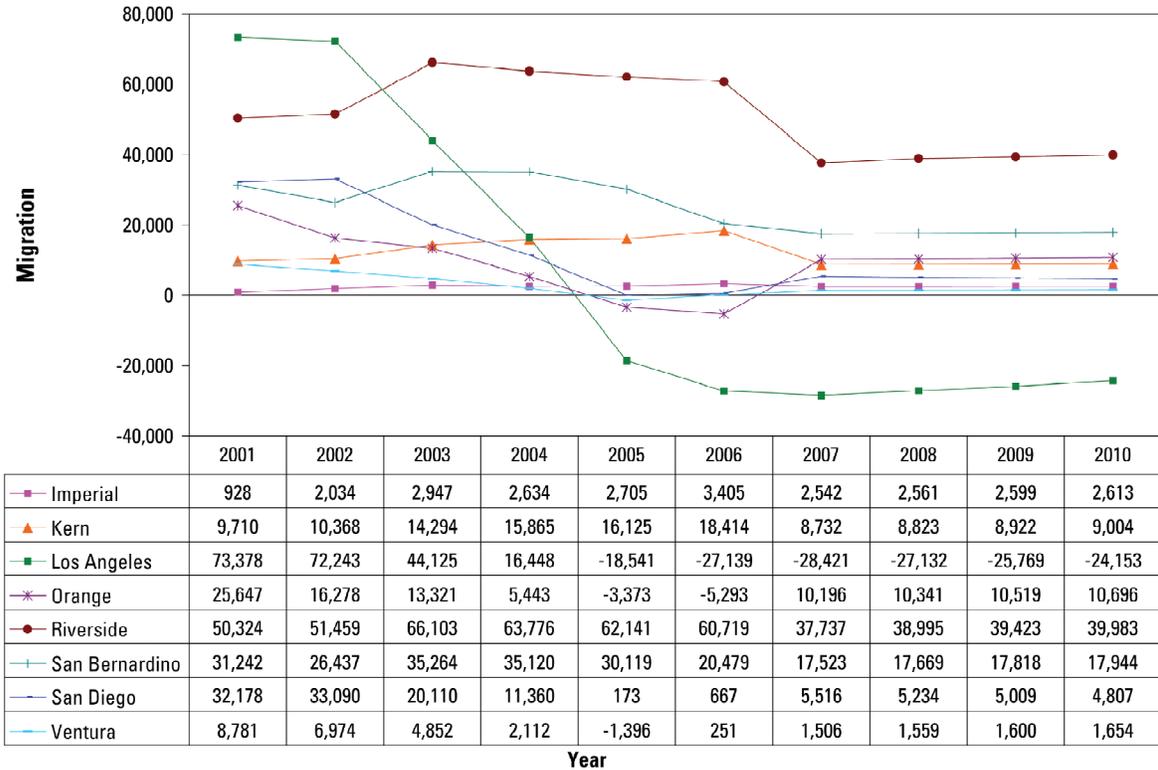


Figure 4. Projected net migration by county, 2001–2010. Riverside County is projected to maintain its lead in net migration.

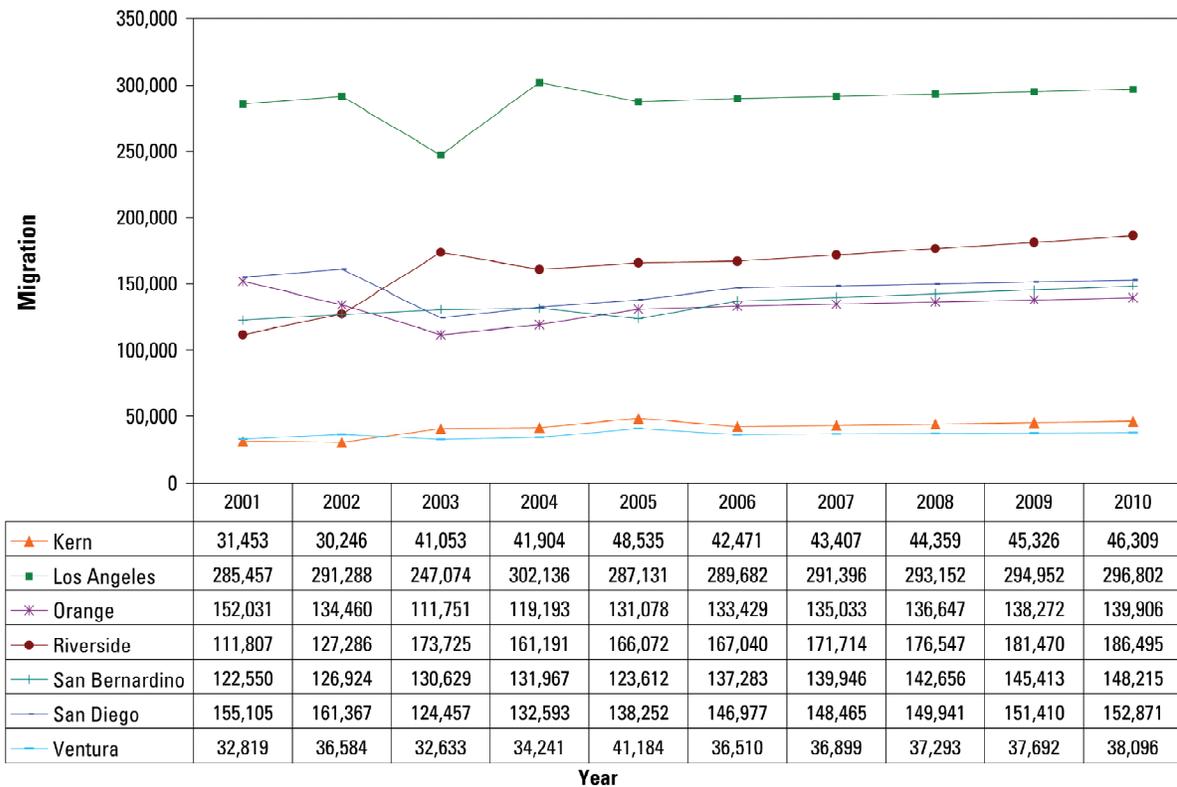
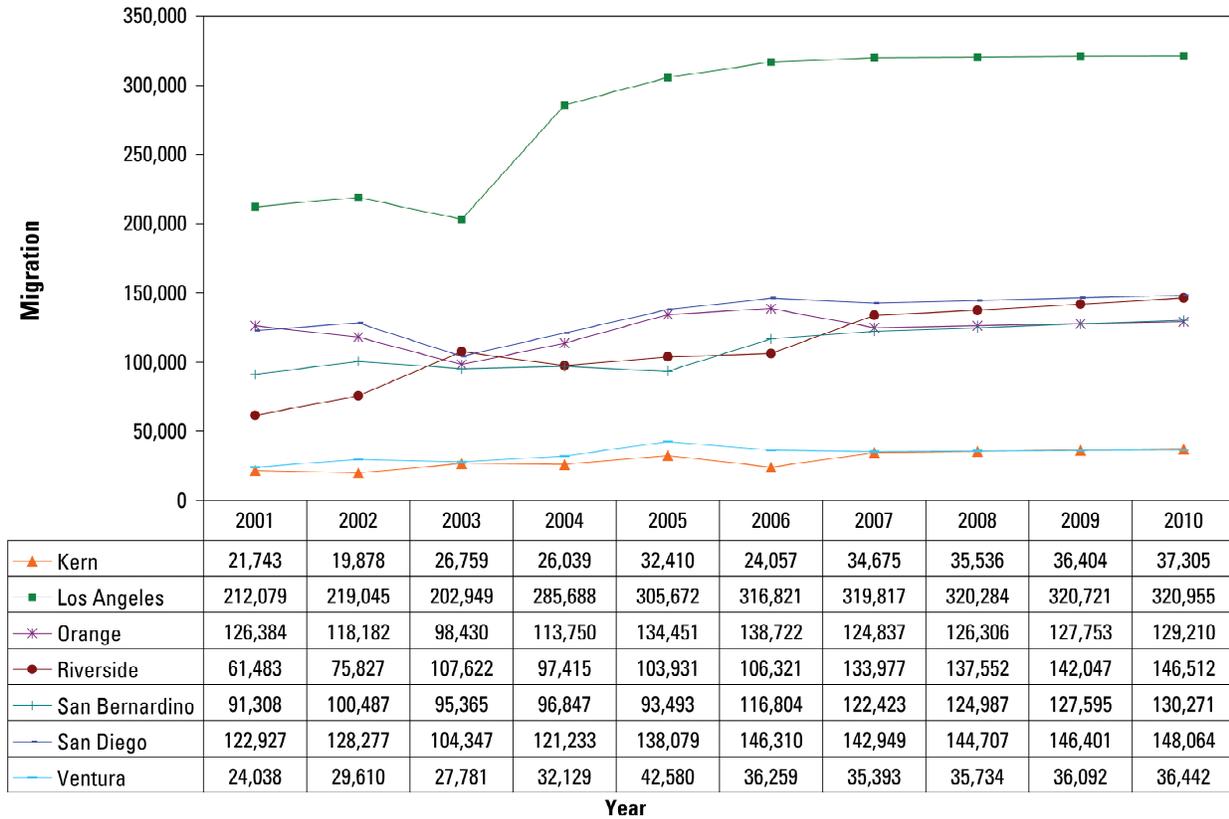
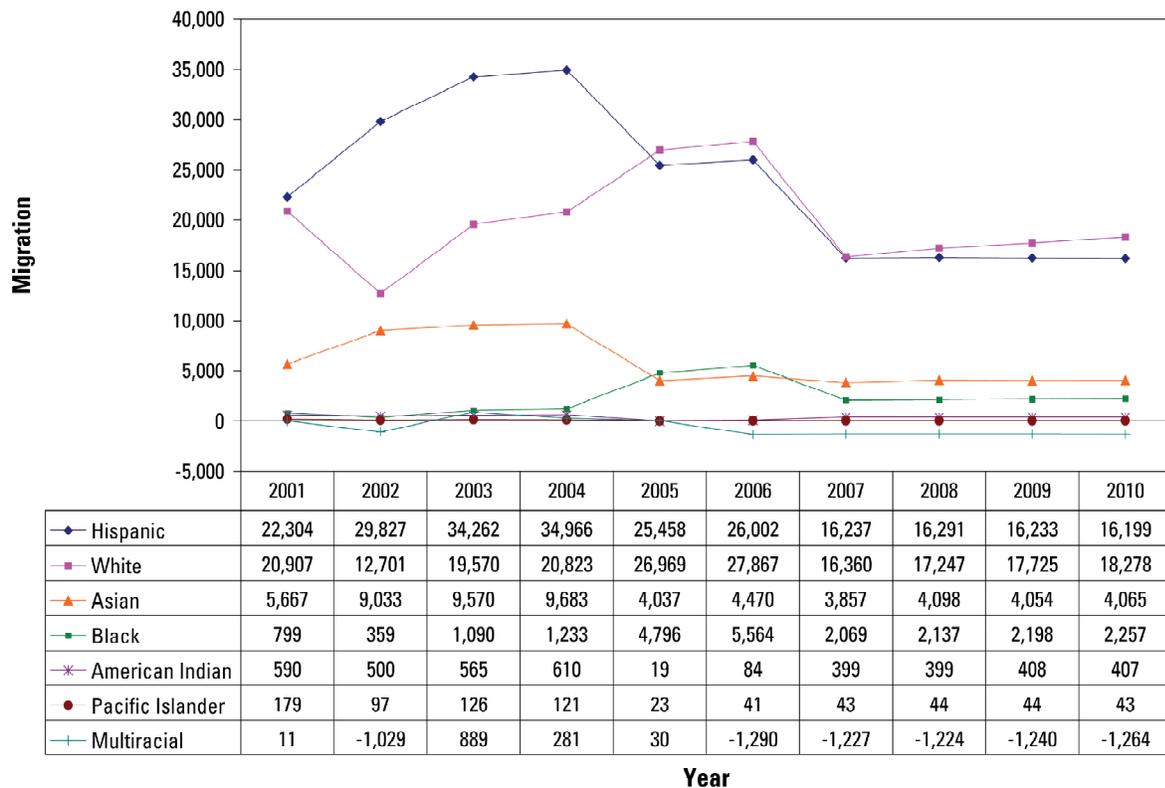


Figure 5. Projected migration inflows by county, 2001–2010. Riverside County is behind only Los Angeles County in projected migration inflows. (Imperial County is not included in this projection.)

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**Figure 6.** Projected migration outflows by county, 2001–2010. Los Angeles County leads in projected migration outflows, while Riverside County increases slightly. (Imperial County is not included in this projection.)



**Figure 7.** Projected net migration by race for Riverside County, Calif., 2001–2010.

## Discussion

The analysis provides some general characterizations of the population that has migrated to and from Southern California counties in recent history, along with near-term projections of migration trends based on current estimates and assumptions of similar conditions through 2010. The analysis is meant to serve as a baseline for comparison of alternative scenarios in which the ShakeOut Scenario earthquake either does or does not occur and how these alternatives might affect regional migration. The characteristics of these migrating populations might also assist in identifying groups that would be most vulnerable to such an earthquake. The projections rely heavily on existing estimates obtained from multiple data sources and results derived using different methodologies at the Federal and State levels. The analysis does not attempt to account for any variations in migration caused by changes in economic activity or by other unforeseen events.

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## **Appendix. Descriptions and Names of Supplementary Files Containing Additional Population Migration Characteristics**

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**Supplementary Files in Portable Document Format (.pdf)**

Description	File name <sup>1</sup>
Net, Inflow, and Outflow Migration by Age, 1995–2000	<a href="#">county_migration_1995_2000_age.pdf</a>
Net, Inflow, and Outflow Migration by Educational Attainment, 1995–2000	<a href="#">county_migration_1995_2000_educational_attainment.pdf</a>
Net, Inflow, and Outflow Migration by Hispanic Origin, 1995–2000	<a href="#">county_migration_1995_2000_hispanic.pdf</a>
Net, Inflow, and Outflow Migration by Household Income, 1995–2000	<a href="#">county_migration_1995_2000_household_income.pdf</a>
Net, Inflow, and Outflow Migration by Household Type, 1995–2000	<a href="#">county_migration_1995_2000_household_type.pdf</a>
Net, Inflow, and Outflow Migration by Housing Tenure, 1995–2000	<a href="#">county_migration_1995_2000_housing_tenure.pdf</a>
Net, Inflow, and Outflow Migration by Industry, 1995–2000	<a href="#">county_migration_1995_2000_industry.pdf</a>
Net, Inflow, and Outflow Migration by Labor Force Status, 1995–2000	<a href="#">county_migration_1995_2000_labor_force_status.pdf</a>
Net, Inflow, and Outflow Migration by Marital Status, 1995–2000	<a href="#">county_migration_1995_2000_marital_status.pdf</a>
Net, Inflow, and Outflow Migration by Occupation, 1995–2000	<a href="#">county_migration_1995_2000_occupation.pdf</a>
Net, Inflow, and Outflow Migration by Poverty Status, 1995–2000	<a href="#">county_migration_1995_2000_poverty_status.pdf</a>
Net, Inflow, and Outflow Migration by Race, 1995–2000	<a href="#">county_migration_1995_2000_race.pdf</a>
Net, Inflow, and Outflow Migration by Sex, 1995–2000	<a href="#">county_migration_1995_2000_sex.pdf</a>
Net, Inflow, and Outflow Migration by Total Income, 1995–2000	<a href="#">county_migration_1995_2000_total_income.pdf</a>
Net, Inflow, and Outflow Migration by Total Population, 1995–2000	<a href="#">county_migration_1995_2000_total_population.pdf</a>
Inflow Migration by Age, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_age.pdf</a>
Inflow Migration by Educational Attainment, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_educational_attainment.pdf</a>
Inflow Migration by Household Type, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_household_type.pdf</a>
Inflow Migration by Housing Tenure, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_housing_tenure.pdf</a>
Inflow Migration by Marital Status, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_marital_status.pdf</a>
Inflow Migration by Poverty Status, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_poverty_status.pdf</a>
Inflow Migration by Sex, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_sex.pdf</a>
Inflow Migration by Total Income, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_total_income.pdf</a>
Net Migration Trend by Race, 2001–2010	<a href="#">pop_components_2001_2010_baseline_race.pdf</a>
Net, Inflow, and Outflow Migration Trend by Total Population, 2001–2010	<a href="#">pop_components_2001_2010_baseline_total_population.pdf</a>

<sup>1</sup>Click on file name to access document.

## Supplementary Files in Excel Format (.xls)

Description	File name <sup>1</sup>
Net, Inflow, and Outflow Migration by Age, 1995–2000	<a href="#">county_migration_1995_2000_age.xls</a>
Net, Inflow, and Outflow Migration by Educational Attainment, 1995–2000	<a href="#">county_migration_1995_2000_educational_attainment.xls</a>
Net, Inflow, and Outflow Migration by Hispanic Origin, 1995–2000	<a href="#">county_migration_1995_2000_hispanic.xls</a>
Net, Inflow, and Outflow Migration by Household Income, 1995–2000	<a href="#">county_migration_1995_2000_household_income.xls</a>
Net, Inflow, and Outflow Migration by Household Type, 1995–2000	<a href="#">county_migration_1995_2000_household_type.xls</a>
Net, Inflow, and Outflow Migration by Housing Tenure, 1995–2000	<a href="#">county_migration_1995_2000_housing_tenure.xls</a>
Net, Inflow, and Outflow Migration by Industry, 1995–2000	<a href="#">county_migration_1995_2000_industry.xls</a>
Net, Inflow, and Outflow Migration by Labor Force Status, 1995–2000	<a href="#">county_migration_1995_2000_labor_force_status.xls</a>
Net, Inflow, and Outflow Migration by Marital Status, 1995–2000	<a href="#">county_migration_1995_2000_marital_status.xls</a>
Net, Inflow, and Outflow Migration by Occupation, 1995–2000	<a href="#">county_migration_1995_2000_occupation.xls</a>
Net, Inflow, and Outflow Migration by Poverty Status, 1995–2000	<a href="#">county_migration_1995_2000_poverty_status.xls</a>
Net, Inflow, and Outflow Migration by Race, 1995–2000	<a href="#">county_migration_1995_2000_race.xls</a>
Net, Inflow, and Outflow Migration by Sex, 1995–2000	<a href="#">county_migration_1995_2000_sex.xls</a>
Net, Inflow, and Outflow Migration by Total Income, 1995–2000	<a href="#">county_migration_1995_2000_total_income.xls</a>
Net, Inflow, and Outflow Migration by Total Population, 1995–2000	<a href="#">county_migration_1995_2000_total_population.xls</a>
Inflow Migration by Age, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_age.xls</a>
Inflow Migration by Educational Attainment, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_educational_attainment.xls</a>
Inflow Migration by Household Type, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_household_type.xls</a>
Inflow Migration by Housing Tenure, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_housing_tenure.xls</a>
Inflow Migration by Marital Status, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_marital_status.xls</a>
Inflow Migration by Poverty Status, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_poverty_status.xls</a>
Inflow Migration by Sex, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_sex.xls</a>
Inflow Migration by Total Income, 1995–2000 (annual average), 2004–2005	<a href="#">county_migration_1995_2000_2004_2005_total_income.xls</a>
Net Migration Trend by Race, 2001–2010	<a href="#">pop_components_2001_2010_baseline_race.xls</a>
Net, Inflow, and Outflow Migration Trend by Total Population, 2001–2010	<a href="#">pop_components_2001_2010_baseline_total_population.xls</a>

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