# Impacts of the 2001 Peru Tsunami in Camana

**International Tsunami Survey Team: Sebastian Araya, Jose Borrero, Lori Dengler[1], Brandon Gomer, Shunichi Koshimura, Gustavo Laos, Daniel Olcese, Emile Okal, Modesto Ortiz, Matt Swensson, Vasily Titov, and Fernando Vegas**

[1]***U.S. Geological Survey, Menlo Park, California, U.S.A.***

**Abstract.** The tsunami generated by the 23 June 2001 Peru earthquake caused significant damage to a 20-km long stretch of coastline in the Municipality of Camana. Over 2000 structures were damaged or destroyed and 2000 hectares of farmland flooded and covered with sand. Twenty-two people were killed in the Municipality and 62 were reported missing. All of the casualties were attributed to the tsunami; the earthquake produced Modified Mercalli Intensities of VI–VII. The ITST group spent 4 days in the Camana area measuring inundation and speaking with City, Red Cross, and Health Department officials, and interviewing survivors. The preliminary ITST findings:

- Developed beaches are particularly vulnerable. Damage was concentrated along a flat coastal beach no higher than 5 m above sea level. The largest waves (5–7 m) produced by this tsunami coincided with the most developed beach area along the southern Peruvian coast. Tsunami waves penetrated 1-km inland and damaged or destroyed nearly all of the structures in this zone.
- Construction method and quality affects survival. Poorly built adobe and infilled wall structures performed very poorly in the tsunami impacted area. The few structures that survived appeared to have deeper foundations and more reinforcing.
- The most tsunami-vulnerable populations were newcomers to the coast. Most victims were farm workers and domestic summerhouse sitters who had not grown up along the coast and were unaware of tsunami hazards.
- Economic impacts are likely to last a long time. The main industries in Camana are tourism and agriculture and the tsunami damaged both.
- While the extent of inundation and the number of structures damaged or destroyed was significant, the number of lives lost was considerably less than during several other recent tsunamis. We attribute the difference in casualties to several factors:

    1. A tsunami-aware coastal population. Many of the people we interviewed knew what tsunamis were, recognized the water draw down as a sign of danger and self-evacuated.
    2. Time of year. The earthquake and tsunami occurred in winter. The summer resident population of the Camana beach towns increases by 5000 people, plus there is an additional influx of tourists. Had the same earthquake occurred in the summer when the beach discotheques, hotels, and cafes were full, casualties could have been orders of magnitude higher.
    3. Time of day. The earthquake and tsunami occurred in mid-afternoon. Seeing the water retreat was the key to self-evacuation. Had the earthquake occurred at nighttime, fewer people may have responded.
    4. Ambient tide level. The tsunami coincided with a minus 40 cm (–1.2 ft) tide, one of the lowest tides of the year.
    5. Initial drawdown of water and period of wave. Eyewitnesses concurred that the tsunami presented as a drawdown on the order of 5 m that lasted at least 15 min. Even people who were unaware of tsunamis thought this behavior very unusual and had timed to reach higher ground.

[1]Department of Geology, Humboldt State University, #1 Harpst St., Arcata, CA 95521, U.S.A. (lad1@humboldt.edu)