



UNESCO/IOC – NOAA ITIC Training Program in Hawaii (ITP-Hawaii)  
TSUNAMI EARLY WARNING SYSTEMS  
AND THE PACIFIC TSUNAMI WARNING CENTER (PTWC) ENHANCED PRODUCTS  
TSUNAMI EVACUATION PLANNING AND UNESCO IOC TSUNAMI READY PROGRAMME  
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# 12.3 Lessons Learned from Palu Tsunami Assessment on the Last Mile's Response

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# Assessment Team



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# Chronology Upstream and Downstream

## 28 September 2018

Earthquake of 5.9 Mw 15:00

15:00 Earthquake felt by people in Donggala and Palu

Many received SMS blast of the BMKG EQ Information (Ministry of Communication and Information) **Communities in Labean villages evacuated to the hills**

Earthquake of 7.7 Mw 18:02

18:02 Strong shaking and difficult to stand still

18:04 Electricity and Communication cut off in Donggala and Palu



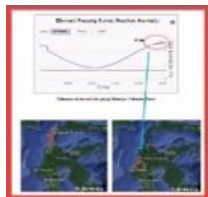
BMKG Bulletin 1  
Advisory in Palu and  
Warning in Donggala 18:07

18:06 Tsunami Arrives in Wani (based on CCTV of Mr. Andi) → 3 min 30 sec after the EQ



TEWS Breaking  
News in Metro TV 18:10

Tsunami hits Palu coast  
Estimated 18:10 – 18:13



6 cm Tsunami observed  
in Mamuju tide gauge  
(+300km South) 18:27



BMKG Bulletin 4  
End of Warning  
for the 7.7 EQ in  
Donggala 18:36

Tsunami hits Palu coast  
videos went viral in  
Social Media



# Eyewitness Interviews



**In-depth interviews with eyewitness and survivors:**

- 1. Perception, knowledge, and understanding on Tsunami Early Warning System.**
- 2. Reaction, action, and response of the community during the event.**

**70 eyewitnesses and survivors interviewed in Palu and Donggala**

**Focus Group Discussion.**

**Meeting with BMKG, BPBD, Electronic Media, Local academician, and Civil societies working on DRR**



# Areas hits by Tsunami



**Bappeda Palu:**  
Casualties in Palu 3.679 persons, **1.252 caused by tsunami** the remaining due to EQ and liquefaction.

**BPBD Donggala:**  
Casualties in Donggala (death and missing) 212 person, **48 caused by tsunami**

# Main findings

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1. Limitations of Existing Tsunami Early Warning System
2. Tsunami Early Warning Chain Failure
3. False Sense of Security
4. Importance of Evacuation Plans and Routes
5. The Importance of Internalizing Experience and Local Knowledge
6. Preparedness, Awareness, and Education Must Be Based on the Characteristics of Local Threats





# 1. Limitations of Existing Tsunami Early Warning System

## 1. The first wave arrives in minutes, earlier than the warning\*



\*  
*Experts reported that the tsunami source was several submarine landslides very close to the coast which caused a very local tsunamis and the first arrives in very short time*

**The 7.7 Mw EQ  
18:02:54**

**~ 3' 35"**

**Tsunami Hits  
18:06:29**



# 1. Limitations of Existing Tsunami Early Warning System

## 1. The first wave arrives in minutes, earlier than the warning



EQ starts 18:02:54  
± 00:15:00



EQ stops 18:04:05  
± 01:28:20



First wave arrived 18:06:29  
± 02:56:00



# 1. Limitations of Existing Tsunami Early Warning System

2. Electricity and communication were cut off in 2 minutes after EQ Communities and Disaster Management Offices (Palu and Donggala) did not receive Tsunami Warning Information.



## BMKG Palu Station Office

Communication and connection were cut off after the 7.7 Mw 18:02 EQ.

BMKG Palu Station staff was still responding to the 5.9 Mw 15:00 EQ

# 1. Limitations of Existing Tsunami Early Warning System

2. Electricity and communication were cut off in 2 minutes after EQ Communities and Disaster Management Offices (Palu and Donggala) did not receive Tsunami Warning Information.



BPBD Palu (Local DMO)  
BPBD Palu has Warning Receiver System (WRS) and Siren. However, due to electricity cut of and the generator has been broken for a while, therefore the system does not work and did not receive any tsunami warning information from BMKG



# 1. Limitations of Existing Tsunami Early Warning System

2. Electricity and communication were cut off in 2 minutes after EQ Communities and Disaster Management Offices (Palu and Donggala) did not receive Tsunami Warning Information.



BPBD Donggala (Local DMO)

Do not have WRS nor Siren. They rely information from SMS or WhatsApp messages.

Due to communication cut off, they did not receive any tsunami warning information from BMKG



## 2. Tsunami Early Warning Chain Failure

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### Lack of capacity at the local Disaster Management Office on tsunami early warning system (TEWS)

- Dissemination of warning from Upstream to Downstream failed
- There is no local SOP for TEWS → no decision-making procedures
- Lack of knowledge on TEWS products
- The agreed Palu City Contingency Plan (2012) was not implemented (might be due to change of government)
- Lack of DMO human resource capacity (focus only on respond)
- Government Regulation no 21 (2008) constructed a longer warning chain for decision making that caused “golden time lost” for evacuating people at risk.

## 2. Tsunami Early Warning Chain Failure

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**Lack of capacity at the local Disaster Management Office on tsunami early warning system (TEWS)**

***BPBD Kota Palu, 24/7 EOC on duty  
personnel***

***“.... I have worked in BPBD for 10 years  
but I have not received any training on  
the Warning Receiver System (WRS)...”***

***“... we have siren, but do not test this  
anymore (the 26<sup>th</sup> every month), we also  
turned the volume down to avoid  
panic...”***



# 3. False Sense of Security

## 1. Siren that will not safe people at risk

There is only 1 Siren installed in Palu,



Photo Yusuf Radja Muda, November 2018

Photo Neni Murdani Oct 2018

- The coverage will not reach people at risk in the coastal area of Palu City
- It has not been used for several months and the volume was turned down
- No activation protocol / procedure during emergency
- People does not understand what is the siren for (although some believes having the siren protected them from the tsunami)



### 3. False Sense of Security

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#### 1. Siren that will not safe people at risk

*“... I used to hear the sound every month, but I did not pay attention and do not know what it is for, I do not think I heard it in these last few months”*



*“... I have been here for more or less a year now, but I have never heard, I did not notice there is a siren here”*

# 3. False Sense of Security

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## 2. A tower that is not a siren



- Lack of knowledge on tsunami siren (a telecommunication tower believed as tsunami siren)
- People believe having siren will be safer from tsunami
- People waited for the siren to take action → local tsunami

# 3. False Sense of Security

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## 2. A tower that is not a siren



*“...we were informed this is a tsunami detection tower by the people who constructed this tower. All of us (people in the village) known this as tsunami siren tower. On that day we waited for the siren but there no sound. After the tsunami the maintenance person came and said the siren does not trigger because BMKG already lifted the warning....”*



# 4. Importance of Evacuation Plans and Routes

## Access for evacuation

**Donggala:**

**Death caused by tsunami + 48 lives**

**Rural area where the hills are very close to the coast, there is no barricade going to the hill from the coast**

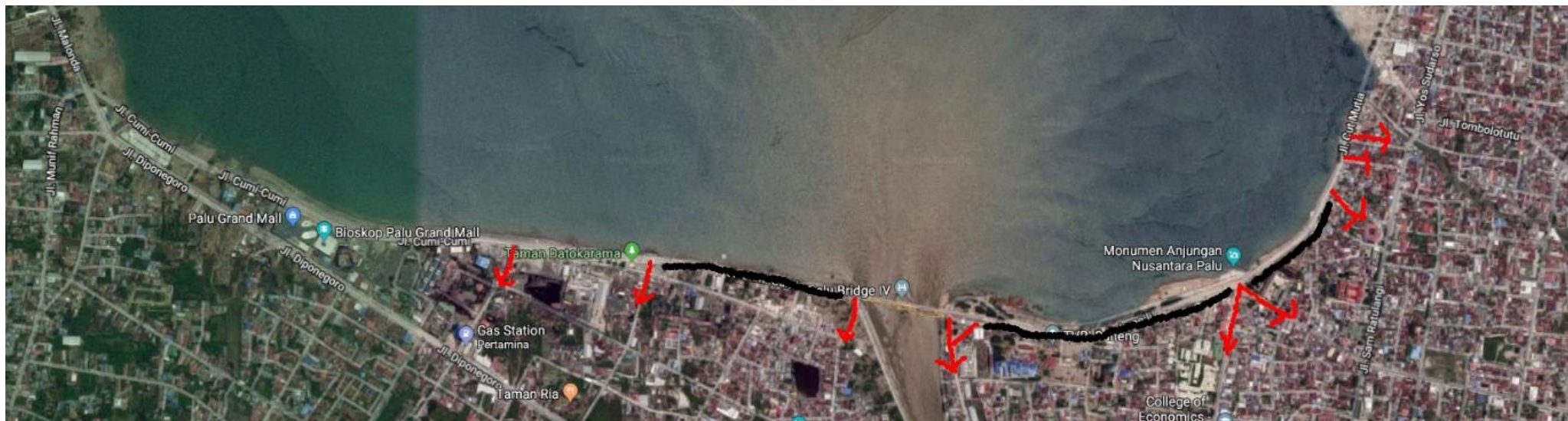
**City of Palu:**

**Death caused by tsunami + 1.252 lives.**

**Urban area access inward from the coast was obstructed by buildings, walls, and fences**

*“...there was the 2018 Palu Nomoni Festival, people already gathered in Palu coast preparing for the festival, after the earthquake and the water came people ran but could not go inward, they have to run along the coast, or, they have to climb the fence and walls, I managed to jump over the wall as the water arrives, but many could not, mostly women and children....”*

TVRI Employee, Palu

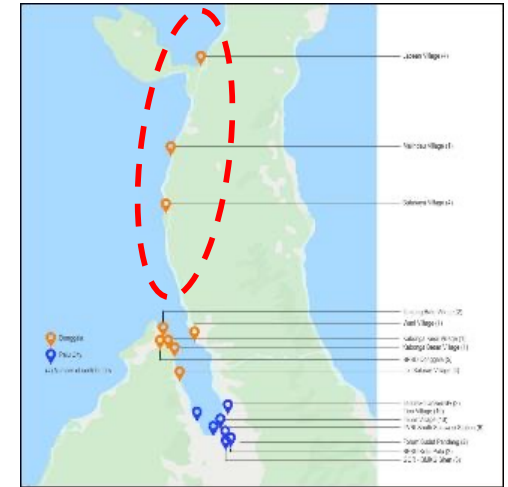


# 5. The Importance of Internalizing Experience and Local Knowledge

## 1. Early Self Evacuation (Labean, Sirenja, Batusuya)

Many of the rural communities evacuated after the 5.9 Mw Earthquake at 15:00

- Knowledge about past tsunami (1968)
- Previous intervention



Eyewitness of 1968 tsunami

*“...after that (earthquake felt at 15:00) we evacuated to the hill with the children ”*

# 5. The Importance of Internalizing Experience and Local Knowledge

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## 1. Early Self Evacuation (Labean, Sirenja, Batusuya)

Designated village disaster management personnel

*"...after the shakking (EQ at 15:00), I told everybody to run, many evacuated to the mountain (hill). Even my children and grand children went to climb the mountain. I told them to bring few clothes, food, and the (already) ripped tent..." "*





# 5. The Importance of Internalizing Experience and Local Knowledge

## 2. Local Knowledge that Save Live, (and not...)

Many of the rural communities knows about past tsunami events (1938 and 1968) → there were still eyewitnesses of the 1968 tsunami in Donggala.



*Experienced 3 tsunamis in a lifetime 1938 (he was 8 years old), 1968 and 2018*

Local languages for tsunami from past events:

Kelli tribe:

- **bulumba bose (Big waves)**
- **balumba latollu (Three waves)**

Mandar tribe:

- **lembo talu (Three waves)**

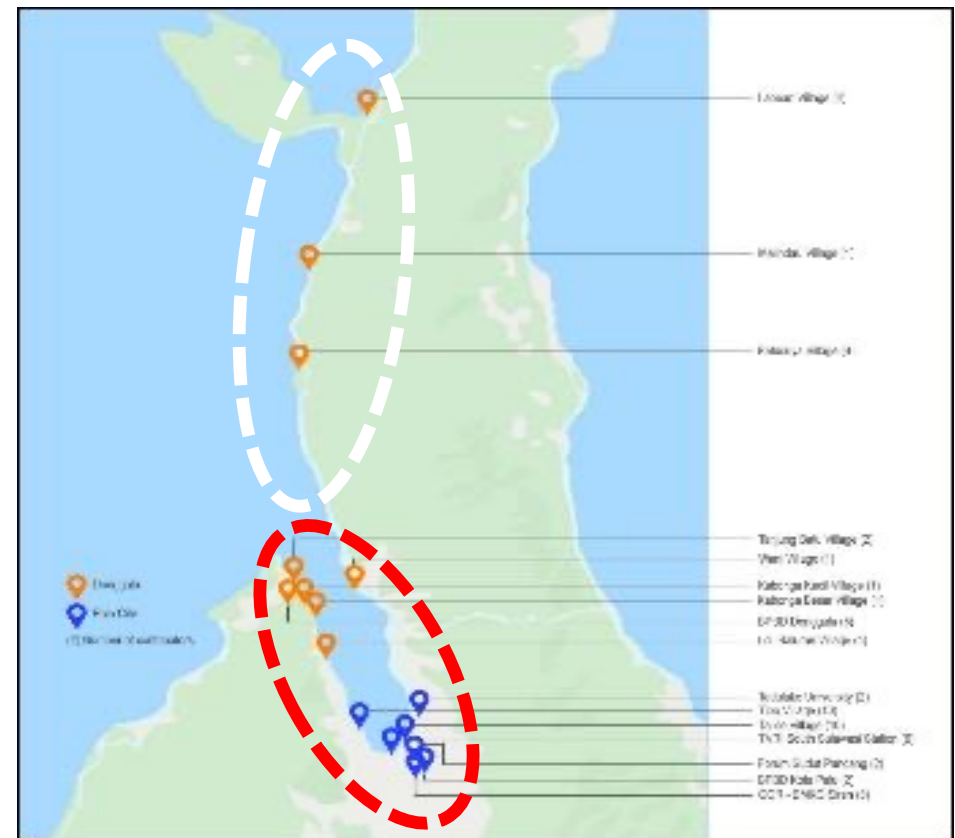
Bugis tribe:

- **bomba tellu (Three waves)**

# 5. The Importance of Internalizing Experience and Local Knowledge

## 2. Local Knowledge that Save Live, (and not...)

- Although most of the eyewitness have heard of the past tsunami that hits Palu (1938 and 1968), many of them considered this as story from the past that will not happened again.
- Many believe with all the advancement of technology, tsunami will not happen in Palu
- Experience of the 6.8 Mw 2005 EQ, where there was no tsunami, they considered that Palu Bay is safe from Tsunami



## 5. The Importance of Internalizing Experience and Local Knowledge

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### 3. Natural Signs that trigger actions

- Many people on the coast saw strange phenomenon of the sea that trigger them to evacuate from the beach
- Strange behavior of animals (Cows, Goats, and Cats) direct the people to evacuate

*“... I was working on my boat when the earth shook when I looked at the sea I saw bubbles on the surface looks like the water is boiling. Short after, I ran and telling people to also run, then the wave came, I continued to tell people to run as I remembered about the three waves. The tsunami destroyed my children’s house”*

*Nurdin (46)*

*UNESCO/IOC-NOAA SHO  
International Tsunami Information Center  
Loli Saluran Village, Banawa Sub district, Donggala*



## 5. The Importance of Internalizing Experience and Local Knowledge

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### 3. Natural Signs that trigger actions

*“...I was doing my ablution, preparing for the Maghreb prayer, when I felt the earth shook. I ran outside to the street, then I saw all the goats running across the street to the hills, also all the birds fly away from the mangrove trees behind my house. The goats ran while the earth was still shaking, after the shaking stops, I heard people running from the coast yelling the sea water is rising !!”*

*Suhardin (37)*

*Kabonga Kecil Village, Banawa Sub district,  
Donggala*

## 5. The Importance of Internalizing Experience and Local Knowledge

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### 3. Natural Signs that trigger actions

*“...while it was shaking I tried to go out from the house. I can barely stand, then I saw the cows are running away from the coast along the street in front of my house. I started to run along with them and was almost stamped down by these cows!”*

*Eli (63)  
Labean Village  
Sub district, Donggala*

## **6. Preparedness, Awareness, and Education Must Be Based on the Characteristics of Local Threats**

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### **Education Materials versus Reality**

- **Education materials was based on 2004 Aceh Tsunami does not correspond to local threat of Palu**
- **Tsunami Drills always started with siren**
- **Tsunami started with the sea water receded**
- **Siren will be activated when tsunami occurs**
- **No public knowledge of other potential source of tsunamis**
- **The lead time for tsunami to arrive in Palu is around 20-30 minutes**
- **Most people in Palu (even the intellectuals) were convinced that Palu bay is not facing tsunami threat**



## 6. Preparedness, Awareness, and Education Must Be Based on the Characteristics of Local Threats

### Education Materials versus Reality



*“” .... this must be a false tsunami. There’s no siren. No water receding. We thought this should only be a hoax... what happened was different than what we learned 6 years ago...”*

- \* This was based on tsunami drill exercise where the scenarios is based on tectonic EQ outside the Palu bay  
This scenario is adopted in the Palu City Contingency plan

**A youth group for disaster preparedness that was trained in 2012**

## 6. Preparedness, Awareness, and Education Must Be Based on the Characteristics of Local Threats

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### Education Materials versus Reality

**In the coast of Palu (Pantai Talise) and Tanjung, Donggala, the land collapsed to the sea as the earthquake happened and the water came immediately**



*“... I was on the quay in Talise Beach, preparing my vendor stall for the Festival, I felt the afternoon EQ (15:00) and I had bad feeling about it, but I decided to stay. As evening EQ (18:00) happened the quay where I was on collapsed, I fell into the sea. I struggled to stay afloat but the wave kept on pulling me down, I felt like I am inside a blender being spin around under water. Until suddenly I was tossed up to the surface and able to hold on to a plank around my neck. I was then drifted to a fallen tree where I can climb. I hold on there until somebody helped me....”*

## 6. Preparedness, Awareness, and Education Must Be Based on the Characteristics of Local Threats

### Education Materials versus Reality



*“...there was no sea water receded, in this area, all the houses just collapsed, sunk into the sea and the water came at the same time...”*

Tanjung Batu Village, Donggala





# Summary

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- Self-Evacuation Protocol is the key to survive local tsunami with a very short lead time.
- Local knowledge need to be capitalized to educate local community on risk understanding, tsunami hazard areas, early warning, as well as action for response/ to save live
- Education, awareness, and preparedness need to be prioritized given a high urgency (all over the country, especially areas with high tsunami threat).
- Risk understanding and knowledge need to be understood by all people in the tsunami risk area.
- End to End Tsunami Early Warning System need to be revitalized, starting and focusing from the downstream part.
- Simplify the Warning Chain and decision-making process (reevaluati the PP 21 (2008))





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# Thank You

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