The E-Observing System for Small Long-line Fishing Vessels Developed by the Fishery Agency of Taiwan

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Contents

1. Background and Goal
2. E-Monitoring System
3. E-Reporting System
4. Test Results and Discussions
5. Summary

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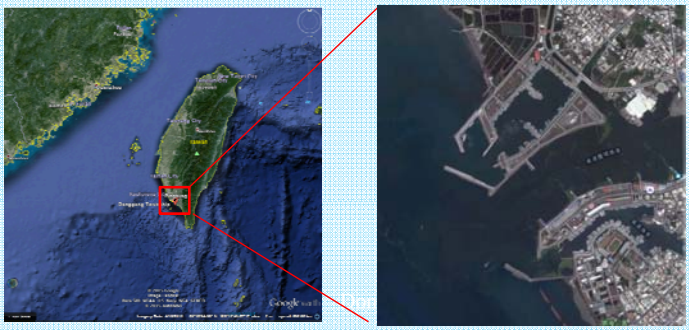
Small Longline Vessels in Taiwan and Their Practices

- There are many 20-meter-long small longline vessels in Taiwan.
- Most of them harbor in Dongkang fishing port in southern Taiwan.
- Those fishing vessels operate in Taiwan coastal waters, the South Pacific, the Indian Ocean and etc.



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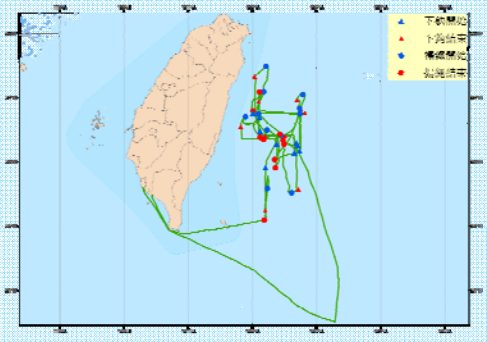
Small Longline Vessels in Taiwan and Their Practices

- Longline operations included:

  Casting, Waiting, Hauling and Moving between fishing grounds.
  Usually, it performs the same operation every day.



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Small Longline Vessels in Taiwan and Their Practices

- The length of these long-line fishing vessels is less than 24 meters.
- Living space is quite limited, not room for additional person.
- An additional person, such as observer on board induces a considerable burden.

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Background:

1. An observer on small long-line fishing vessels bring a great burdens due to its tight space.
2. On board observer collect various data, such as type and size of catches, by-catch, operation sea area and etc..
3. An proper E-Observing System might replace the on board observer's duties.

Goals:

Developing an Electric Observing System to substitute the on board human observer.

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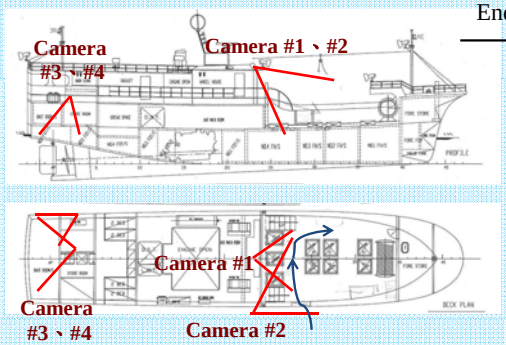
Overview of the E-Observing System

E-Monitoring System



End of trip

E-Reporting System

Still images of catches → Catches information

Still images of operation → Fishing operation information

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2. E-Monitoring System

- **on board equipment:**
  - **4 Video cameras**
    two for bait casting operation and two for hauling operation
  - **Digital Video Recorder (DVR) with GPS**
    recording the image of two operations
  - **Control System for camera ON/OFF**
    Synchronize with of hauling operation (Camera #1、#2) and bait casting operation (Camera #3、#4)

Camera #2

DVR

Control system

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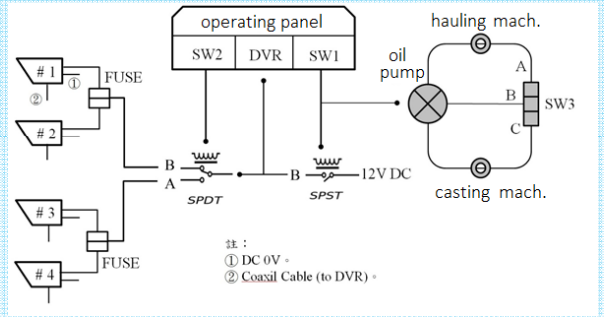
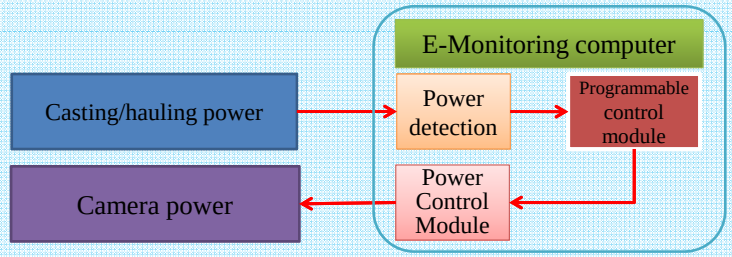
Automatic Power on/off Function



The system startup or shutdown is controlled by casting and hauling operations automatically.

Synchronous Control System (1/2)

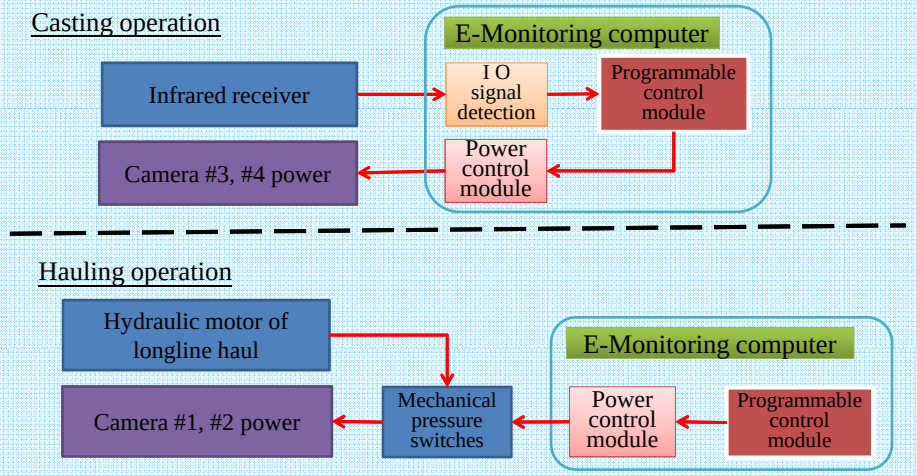
Using power to trigger ON/OFF of video recording module



This architecture targeted at vessels with automatic casting and hauling machine. It uses electronic power as control signal.

Synchronous Control System (2/2)

Using different signal source to trigger ON/OFF of video recording module



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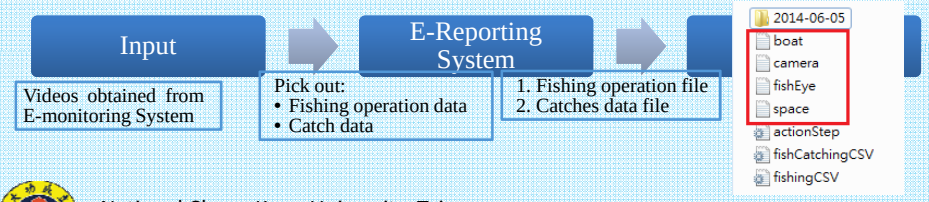
3. E-Reporting System

System Configuration | Fishing Operation | Catch Analysis | Outcomes

General concept of the E-Reporting System

- Input : Videos obtained from the E-monitoring System.
- By using the E-Reporting System, on shore observer surveys these videos, pick out fishing operation data and performs catch analysis.
- Output : fishing operation file and catches data file.
- To perform this system four files were created as E-Monitoring System was installed.



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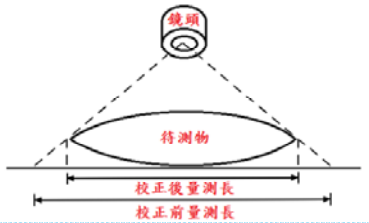
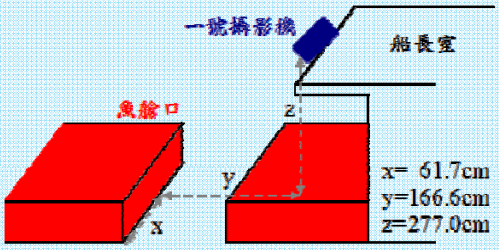
Space Correction

- The space error induced from camera #1 will be eliminated by a calibration process.
- This process is carried out after the E-Monitoring System was set up.

魚體長 (cm)	89	90	94	102	120	122	123	123	123	123	124	126	127	128	128	129	129	129	129	131
魚體厚度(cm)	10	12	14	16	16	18	16	22	20	26	18	22	24	20	22	18	28	20	18	24





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Catches length measurement correction

- Setting a template on the deck floor to produce coordinate system.
- When a catch lies on the floor, measurement by clicking mouse will be performed automatically.

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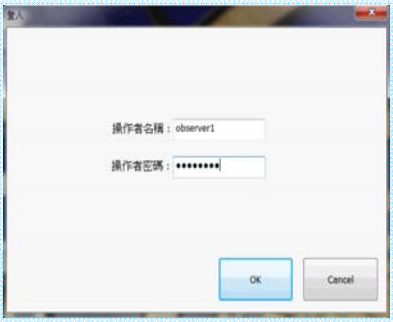
System Configuration | Fishing Operation | Catch Analysis | Outcomes

Log in

Select fishing vessel name

Select Video file name



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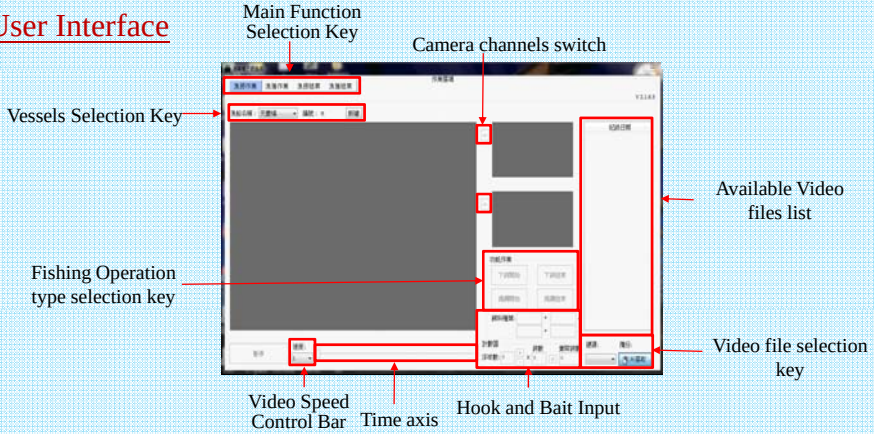
System Configuration | Fishing Operation | Catch Analysis | Outcomes

User Interface



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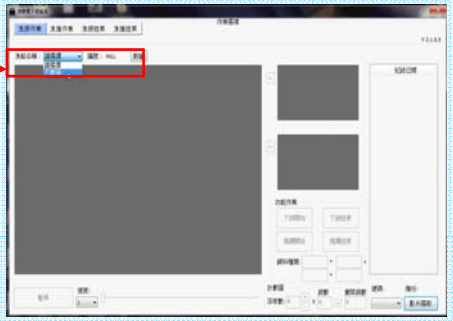
System Configuration | Fishing Operation | Catch Analysis | Outcomes

Log in

Select fishing vessel

Select Video file name

Select vessels name.



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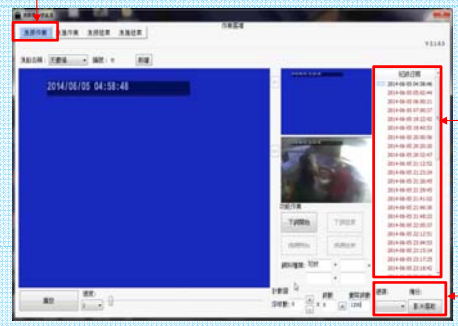
System Configuration | Fishing Operation | Catch Analysis | Outcomes

Fishing Operation Function Key

Log in

Select fishing vessel

Select Video file name



Available video files list

Video selection key

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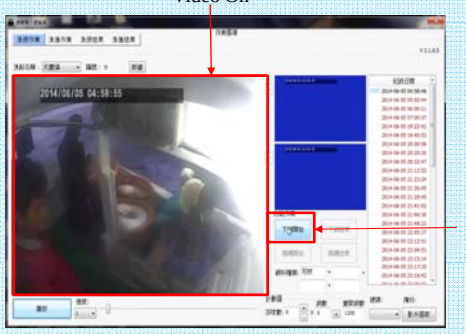
12 請在大銀幕上顯示出影像，而不是在小銀幕。
lin, 2015/10/18

19 lin, 2015/10/19

System Configuration | Fishing Operation | Catch Analysis | Outcomes

- Set Casting Start Time
- Input Casting Information
- Set Casting End Time
- Set Hauling Start/End Time
- Display Fishing Operation Data

Casting Operation Video On



Click Casting Start Key

The longitude, latitude and time will be recorded automatically after clicking.

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14

System Configuration | Fishing Operation | Catch Analysis | Outcomes

- Set Casting Start Time
- Input Casting Information
- Set Casting End Time
- Set Hauling Start/End Time
- Display Fishing Operation Data

Fill in
1. hooks number
2. baits type(four type max)

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114 將拋餌相片放到大銀幕上
lin, 2015/10/20

115

System Configuration | Fishing Operation | Catch Analysis | Outcomes

- Set Casting Start Time
- Input Casting Information
- Set Casting End Time
- Set Hauling Start/End Time
- Display Fishing Operation Data

Click Casting End Key

The longitude, latitude and time will be recorded automatically after clicking.

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System Configuration | Fishing Operation | Catch Analysis | Outcomes

- Set Casting Start Time
- Input Casting Information
- Set Casting End Time
- Set Hauling Start/End Time
- Display Fishing Operation Data

Click
1. Hauling Start Key
2. Hauling End Key

The longitude, latitude and time will be recorded automatically after clicking.

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115 藍色的鍵應該在END-key才對
lin, 2015/10/26

14

System Configuration | Fishing Operation | Catch Analysis | Outcomes

Set Casting Start Time

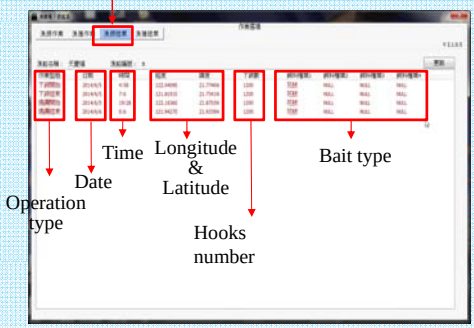
Input Casting Information

Set Casting End Time

Set Hauling Start/End Time

Display Fishing Operation Data

Fishing Operation Display Button



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16
17

System Configuration | Fishing Operation | Catch Analysis | Outcomes

Select Catch Analysis

Video File Selection

Image Capture

Catch Species

Length Measurement

Display Catch Data

Select Catch Analysis Key

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投影片 23

l4 必須將各個內容放大，讓聽講者看得出來。
lin, 2015/10/18

投影片 24

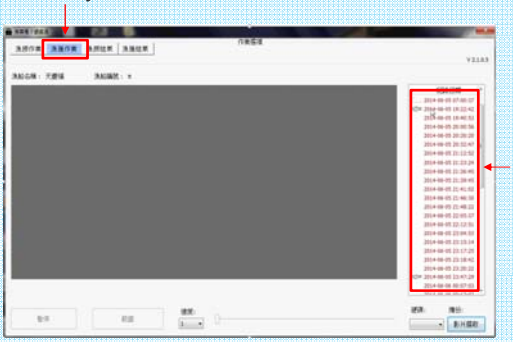
l16 ko4gk6ai7
lin, 2015/10/29

l17 為什麼介面改變了?
lin, 2015/10/29

System Configuration | Fishing Operation | Catch Analysis | Outcomes

Select Catch Analysis
Video File Selection
Image Capture
Catch Species
Length Measurement
Display Catch Data

Catch Analysis On



Select the Video Files to be Analyzed

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System Configuration | Fishing Operation | Catch Analysis | Outcomes

Select Catch Analysis
Video File Selection
Image Capture
Catch Species
Length Measurement
Display Catch Data

The current video file

Click the freeze button to catch the fish picture.

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System Configuration | Fishing Operation | Catch Analysis | Outcomes

Select Catch Analysis
Video File Selection
Image Capture
Catch Species
Length Measurement
Display Catch Data

Following with the freeze click, a new interface having fish's picture will show out.

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System Configuration | Fishing Operation | Catch Analysis | Outcomes

Select Catch Analysis
Video File Selection
Image Capture
Catch Species
Length Measurement
Display Catch Data

input the fish species

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System Configuration | Fishing Operation | Catch Analysis | Outcomes

Select Catch Analysis
Video File Selection
Image Capture
Catch Species
Length Measurement
Display Catch Data

Click the length measurement button.

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17

System Configuration | Fishing Operation | Catch Analysis | Outcomes

Select Catch Analysis
Video File Selection
Image Capture
Catch Species
Length Measurement
Display Catch Data

Click the pout and the tail to measure length.

Show the fish length.

The longitude and latitude will be recorded automatically.

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17 顯示魚長部分獨立標示
lin, 2015/10/19

18

110

Preparation | Fishing Operation | Catch Analysis | Outcomes

Select Catch Analysis

Video File Selection

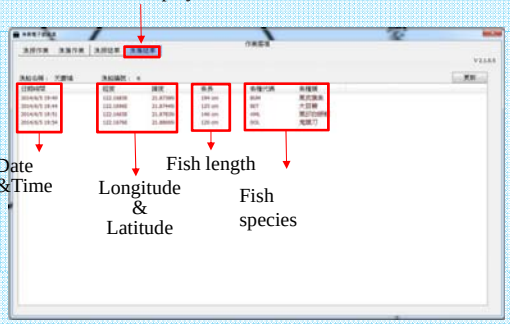
Image Capture

Catch Species

Length Measurement

Display Catch Data

Catch Data Display Button.



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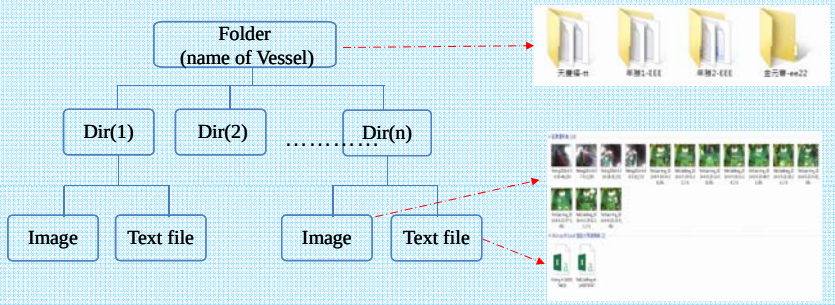
Preparation | Fishing Operation | Catch Analysis | Outcomes

- One day fishing operation (about 16 hours) need 2 hours to survey.
- Below: The obtained file structure of the E-Reporting System
- The outcomes: Catches Image files and Text files.
- The image and detail information of every catch are saved for further usage.



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投影片 31

18 標示清楚
lin, 2015/10/19

110 不能只有一筆數據，必須有多一點漁獲數據
lin, 2015/10/19

4. Test Results and discussion

Measurement of Catch Length (1/3)

A total of 2178 catches collected from 20 voyages of a 17 meter long-line fishing vessel were used to verify its accuracy through three different approaches.

Method 1. Measurement were carried out on the dock by crew member.

Species	Quantity
Yellow fin tuna:	312
Dolphin fish:	1,060
Sailfish :	104
Others:	702

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Measurement of Catch Length (2/3)

Method 2. Carried out in fish market by NCKU staffs:

- Collected from 6 voyages with max. 20 catches per voyage
- yellow fin tuna and dolphin fish are applied.
- These data are regard as actual length.
- A customized retractable ruler ranges are used. (range:20cm to 312cm)
- Number tags tied for identifying. (below left)
- Performing measurements.(below right)

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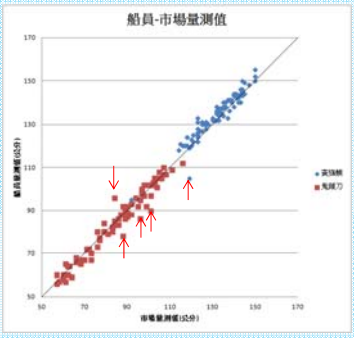
Measurement of Catch Length (3/3)

Method 3. Measurement by E-Reporting System:

- On shore observers survey the video and freeze the images of catches.
- Clicking the point of catches' snout and tail fork by the E-Reporting System.
- System will then calculate the length of the catch automatically.

Error assessment of catch length-1

- Catches length obtained from crew members and NCKU staff are compared.
- The result shows the measurement from crew member and researcher are very identical apart from a few data.



Error assessment of catch length-2

	Dolphinfish			Yellowfin tuna		
No.	Crew	Market	Error	Crew	Market	Error
1	105	103	2	134	135	-1
2	64	62	2	137	134	3
3	82	83	-1	141	137	4
4	90	101	-11	131	127	4
5	80	79	1	125	121	4
6	68	66	2	133	123	10
7	100	97	3	131	123	8
8	96	94	2	136	138	-2
9	88	92	-4	142	141	1
10	67	70	-3	140	135	5
11	99	97	2	128	123	5
12	93	92	1	143	142	1
13	70	73	-3	142	142	0
14	103	102	1	130	127	3
15	105	103	2	138	140	-2
16	73	76	-3	130	126	4
17	65	68	-3	120	117	3
18	64	62	2	133	130	3
19	86	86	0	150	144	6
20	95	96	-1	152	150	2

Unit: cm

- 20 pieces of dolphinfish and yellowfin tuna in one voyage.
- Measurements by crew member are fairly similar compare to that of NCKU staffs.
- Only 2 of them deviate more than 10 cm.

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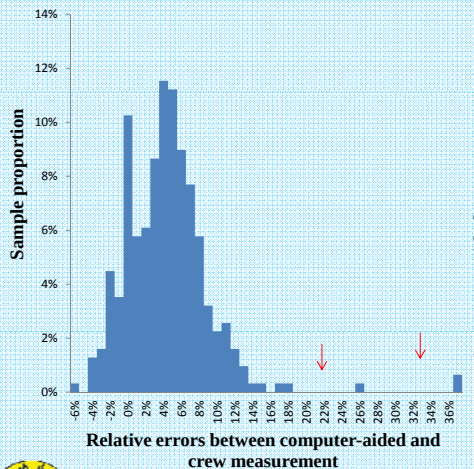
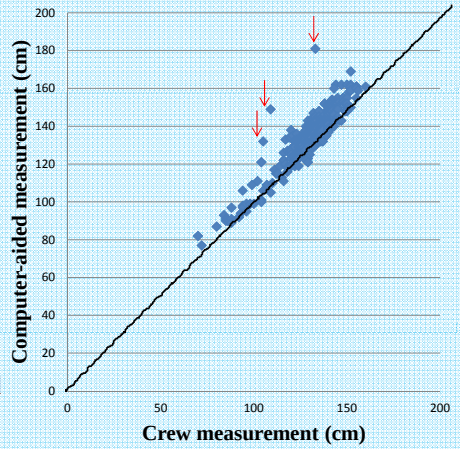
Error assessment of catch length- Yellowfin tuna (n=312)





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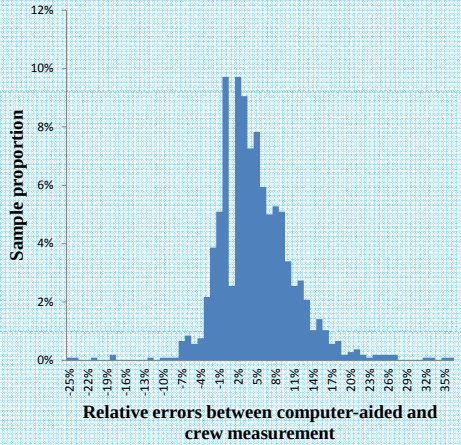
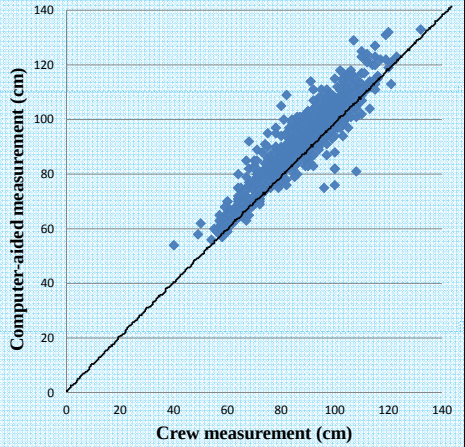
Error assessment of catch length- Dolphin fish (n=1060)





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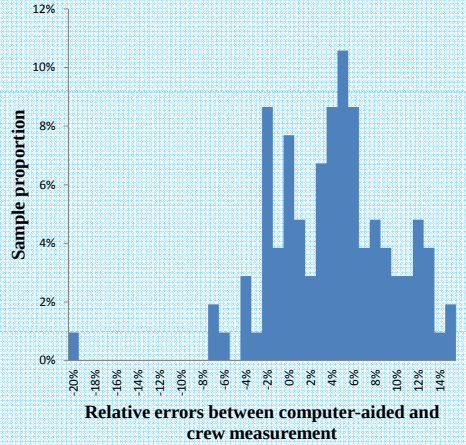
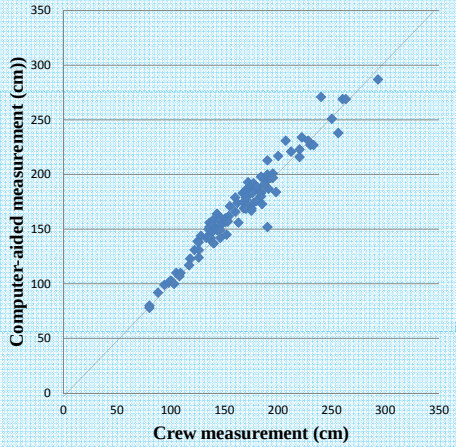
Error assessment of catch length- Sailfish (n=104)





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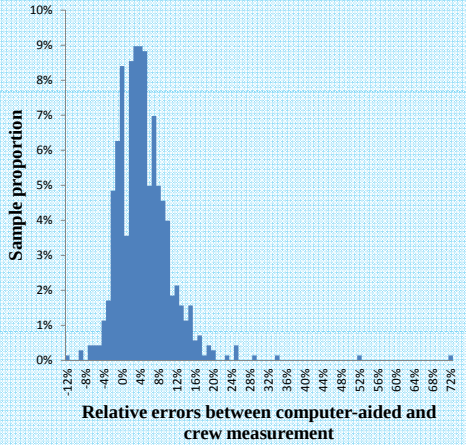
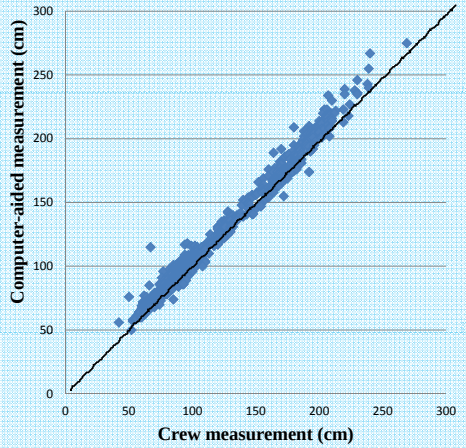
Error assessment of catch length- Others (n=702)





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5. Conclusions

- An E-Monitoring System for small long-line fishing vessels was developed, and it had been tested on a 17 meters long vessel for more than one year.
- More than 2000 catches from 20 voyages show that their lengths measured by the E-Reporting System are very close with the length measured by the crews. Deviations less than 10% occupy about 90% of the data.
- The E-Reporting System is able to retrieve fishing operation information and catch data from the E-Monitoring System. One day fishing operation about16 hours need 2 hours to survey

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5. Conclusions

Since this E-Observing System could collect many valuable data from the recovery videos of E-Monitoring System, it is believed that the developed System possess potential to replace the duties of on board observer.

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Your attention is appreciated

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