Electronic Monitoring in the New Zealand Inshore Trawl Fishery: A Pilot Study

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Background

- DOC's MCS works to examine PS interactions and mitigation measures
- Observers are current monitoring method, but with limitations
- Can Electronic Monitoring be used?
- Sanford expressed interest in developing EM-based ongoing fleet monitoring

Objectives

- Deploy EM on two vessels for extended duration
- Inventory all data and assess for:
  - PS catch
  - PS presence near vessel
  - PS interactions with warp
  - Identification ability for PS
  - Mitigation device use
  - Vessel discharge
- Develop EM-based methodology for above
- Compare EM and Observer data

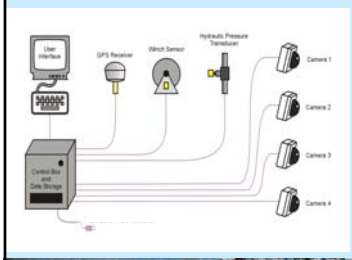
Project Chronology

- Project began (February 2008)
- EM systems on two vessels (Feb-Nov 08)
- Analysis (Aug 08-Mar 09)
- Project report (May 09)
- Final report (Aug 09)
- Full analysis (Sept 09)

Roles

- Project design – DOC, Sanford, Archipelago and Lat37
- Field services (Lat 37)
- EM data interpretation (Archipelago)
- Analysis and report (Archipelago)

Electronic Monitoring



Inshore Trawl Vessels

V2 V1

Example Camera Views – V1

Example Camera Views – V2

Data Capture Specifications

- EM system powered 100% while vessel at sea
- Sensor data recorded continuously
  - 10 second update
- Image data triggered by winch/hydraulics
  - 1-6 fps per camera
  - All cameras activated
  - 30 min run-on

EM Data Inventory

Vessel ID	Service Period	Trips	Sensor Data Expected (Days)	Sensor Data Captured (Days)	Sensor Data Completeness (%)	Image Data Collected (Hours)	Tows Captured	Tows Sampled	Observed Tows
1	Mar-19 to Apr-30	9	34.59*	32.53	94%	171.34	103	17	
	Apr-30 to May-20	2	5.02*	4.87	97%	24.43	16	4	
	May-20 to Jun-24	4	32.66*	23.61	72%	125.54	50	10	
	Jun-24 to Aug-08	6	31.64*	25.72	81%	143.76	86	16	
	Aug-08 to Sep-12	5	20.91*	13.16	63%	70.42	48	8	
	Sep-12 to Sep-25	1	2.31*	1.76	76%	12.96	8	1	
	Sep-25 to Oct-22	3	13.29*	10.75	81%	69.60	42	7	
	Oct-22 to Nov-26	3	14.23*	11.01	77%	69.30	44	7	
	Vessel Totals	**33**	**183.18**	**142.00**	**78%**	**791.14**	**397**	**70**	**0**
2	May-20 to Jun-24	5	19.67	18.29	93%	100.36	75	11	
	Jun-24 to Aug-13	10	37.32*	32.17	86%	40.30	179	13	
	Aug-13 to Sep-02	3	16.51	16.51	100%	138.24	77	14	
	Sep-02 to Sep-26	4	13.31	13.27	100%	93.27	71	45	39
	Sep-26 to Oct-10	5	16.28	13.70	84%	328.12	83	32	21
	Oct-10 to Nov-25	5	27.36	26.06	95%	223.94	140	25	
	Vessel Totals	**32**	**130.44**	**120.00**	**92%**	**924.22**	**625**	**140**	**60**
Overall Totals		**65**	**313.62**	**262.00**	**84%**	**1715.36**	**1022**	**210**	**60**

EM Data Quality Assessment

- GPS – 100% complete
- Winch rotation – 85% complete
- Hydraulic – 50% complete (V2 reversed)
- Imagery – 85% complete
  - High – 58%
  - Medium – 41%
  - Low – 1%

Image Data Inventory

- Total fishing events – 1,022
- Fishing events w/ observer – 60
- Fishing events w/o observer – 962
  - Complete imagery – 822 (84%)
  - Partial imagery (power) – 15
  - Partial imagery (system error) – 150
- Events sampled – 210 (~20%)
  - 60 observer present
  - 150 no observer present (random, time strata)
- Post report – 612 events analyzed

Image Data Inventory cont.

- PS catch – 184 events (88%)
- PS presence near vessel – 171 events (86%)
- PS interactions with warp – 0 events (0%)
- Identification ability for PS – 169 events (86%)
- Mitigation device use – 200 events (95%)
- Vessel discharge - 165 events (79%)

PS Catch

- Def'n: Presence of protected species in fishing gear during net retrieval and catch stowage
- Events:
  - Dolphin #1 – observer and EM detected
  - Dolphin #2 – vessel reported, EM not detected (outside camera view)
  - Gannet – vessel reported, EM detected
- Issues
  - 100% deck area needs to be covered
  - Small PS in catch likely hard to detect

PS Presence Near Vessel

- Def'n: Abundance estimates of PS (mostly seabirds) during shooting and/or hauling of fishing gear (daylight operations).
- EM seabird estimates based on abundance categories
- EM and Observer seabird estimates were correlated.
- EM PS estimates limited in range and resolution.
- PS estimates vary by camera position.

PS Interactions With Warp

- Def'n: Counts of seabird strikes with warp (and mitigation device) during daylight tows.
- No suitable camera placements for this objective.
- Not successful with this objective

PS Identification Ability

- Def'n: Identify PS to lowest taxa possible
- PS catch
  - W/ large PS, ID to species likely
- PS in proximity to vessel
  - W/ large PS, calm seas, close to vessel – ID possible
  - Most seabird classifications were to general groups

Mitigation Device Use

- Def'n: documentation of the type and effectiveness of mitigation gear deployed during fishing operations
- High agreement with observer (93%)
- Night tows more problematic

Vessel Discharge

- Def'n: Estimations of fish discharge (offal or whole fish) during fishing operations (for this fleet essentially fish discards during catch stowage operations).
- Quantification – both species and quantities
- Observer and EM weight estimates w/in 16%.
- EM poorly resolved species (~50% unidentified catch)

Rec/Concl's: EM Performance

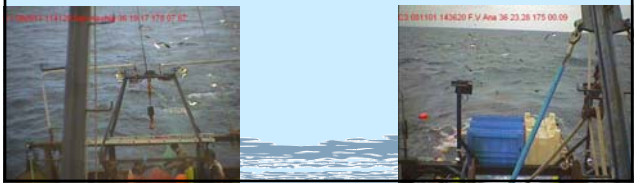
- EM system performed very well overall
- EM power should be continuous (data loss 16%)
- Image recording run on too short
- EM installation opportunistic
- 4 cameras not enough for all monitoring objectives

Rec/Concl's: Monitoring Objectives

- PS Catch
  - Need full view of net and fish handling areas.
  - Need control point for all catch not retained
  - Likelihood of success: High

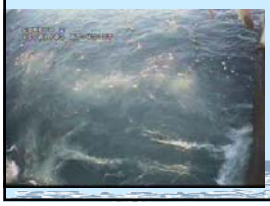
Rec/Concl's: Monitoring Objectives

- PS Presence Near Vessel
  - Consider rank indices of abundance.
  - Place cameras at deck level
  - Likelihood of success: Medium



Rec/Concl's: Monitoring Objectives

- Trawl Warp Monitoring
  - Requires dedicated cameras
  - Seabird strikes difficult to detect
  - Perhaps focus on mitigation instead of warp?
  - Likelihood of success: Low



Rec/Concl's: Monitoring Objectives

- PS Identification
  - Catch
    - Need full view of net and fish handling areas.
    - Need control point for all catch not retained
    - Likelihood of success: Medium to High
  - Near Vessel
    - General species groupings
    - Likelihood of success: Low

Rec/Concl's: Monitoring Objectives

- Mitigation Device Deployment
  - Include in deck camera views
  - Easily monitored
  - Likelihood of Success - High

Rec/Concl's: Monitoring Objectives

- Assessment of Discharge Patterns (Discarded whole fish)
  - Need full view of net and fish handling areas.
  - Need control point for all catch not retained
  - Likelihood of Success - High

Rec/Concl's: Operational

- Narrow communication gaps between vessel, company, field services (Lat37) and analysis (Archipelago)
- EM analysis should be NZ based
- Need larger scale for NZ based infrastructure
- Real time EM 'health status' would be beneficial.

Conclusions - General

- EM cost $383/day, or ~38% of equivalent observer program
- EM could work with industry involvement.
- Benefits of industry engagement huge
- EM would address monitoring needs but different data than observer
- Best option - combined EM and observer monitoring
- EM program takes time and infrastructure