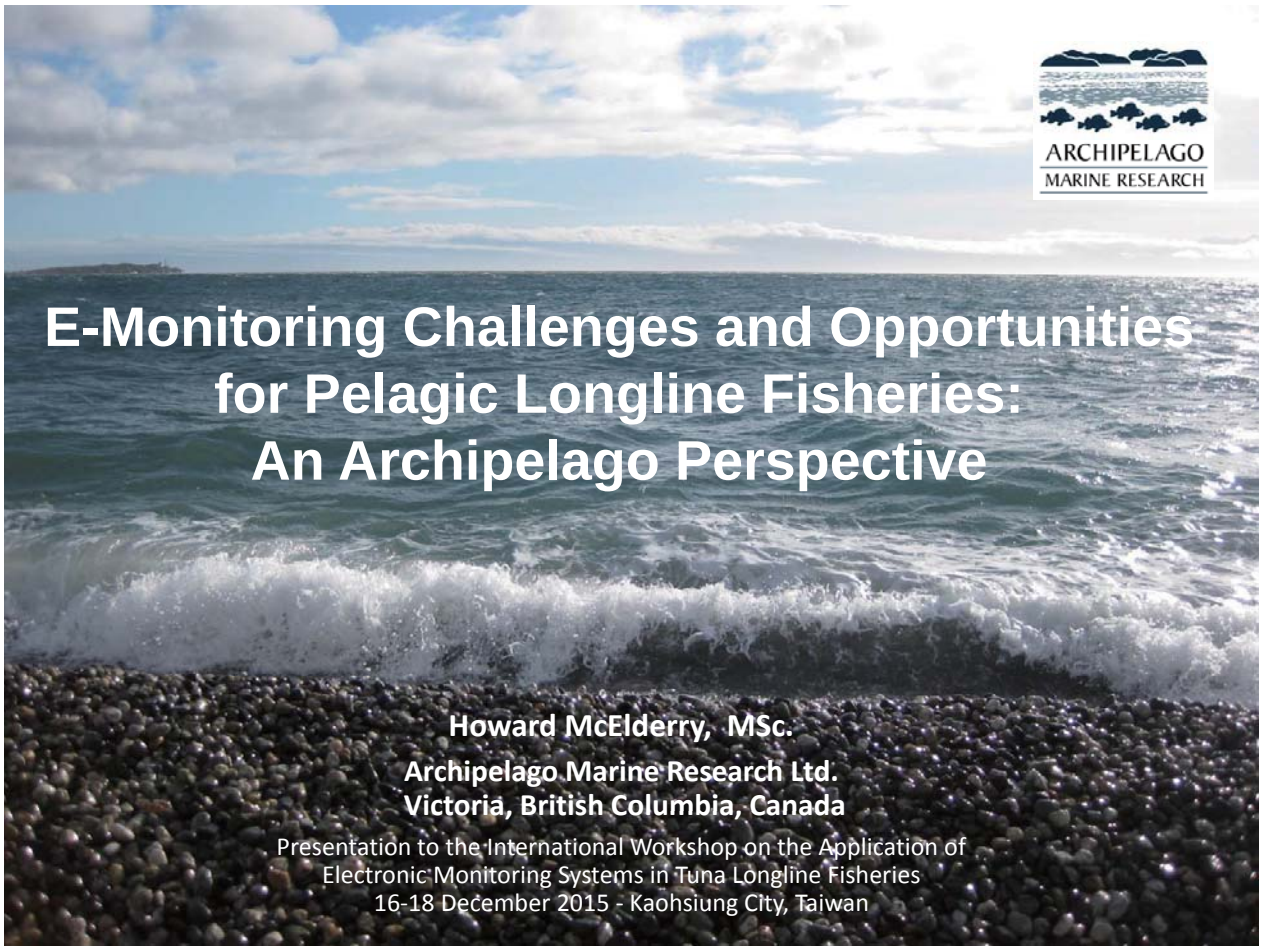

E-Monitoring Challenges and Opportunities for Pelagic Longline Fisheries: An Archipelago Perspective

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Archipelago Marine Research Ltd.
Victoria, British Columbia, Canada

Presentation to the International Workshop on the Application of Electronic Monitoring Systems in Tuna Longline Fisheries
16-18 December 2015 - Kaohsiung City, Taiwan

Outline

- Introduction to Archipelago Marine Research
- Archipelago's EM technology
- Putting EM to work
- Opportunity assessment for pelagic longline fisheries
- Conclusions

About Archipelago

- Established: 1978
- Specialty: marine science and technology
- Offering: professional services, and specialised technology products
- Employees: ~170
- Clients: government, industry, NGOs
- Office locations:
  - Victoria BC, Canada
  - Canberra ACT, Australia

Key Business Areas

- Marine environmental services
- Fisheries observer programs
- Electronic monitoring programs

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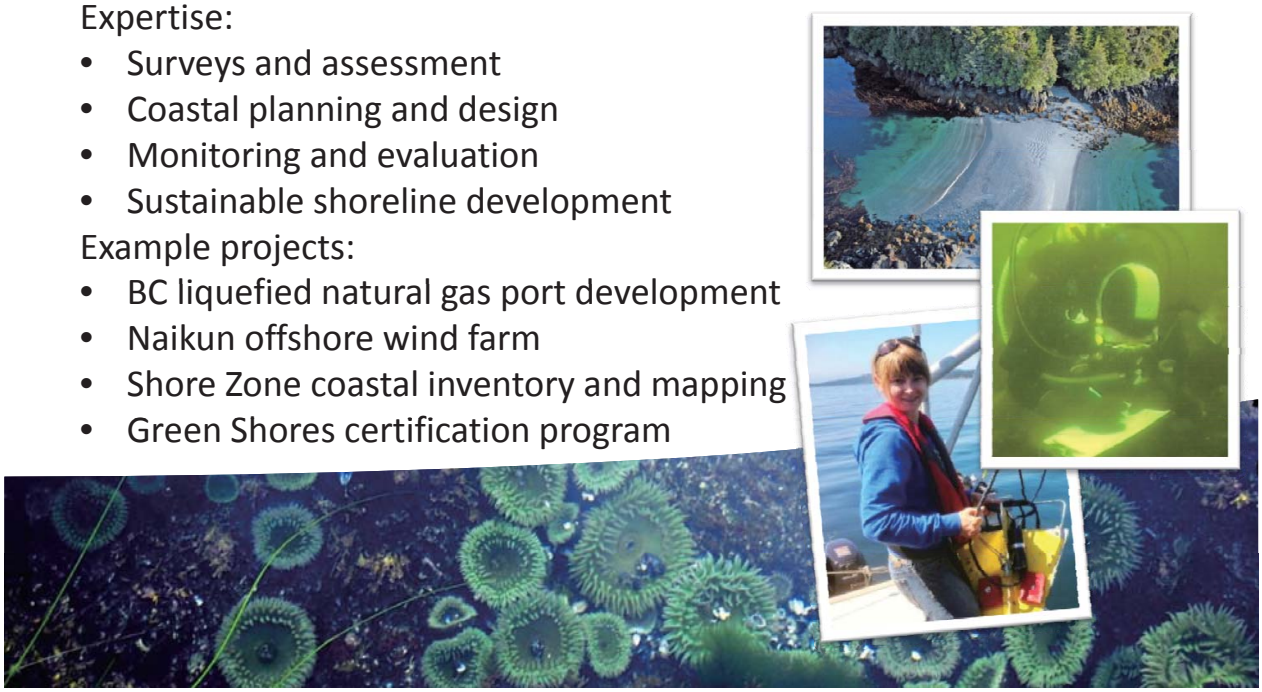
Marine Environmental Services

Expertise:

- Surveys and assessment
- Coastal planning and design
- Monitoring and evaluation
- Sustainable shoreline development

Example projects:

- BC liquefied natural gas port development
- Naikun offshore wind farm
- Shore Zone coastal inventory and mapping
- Green Shores certification program



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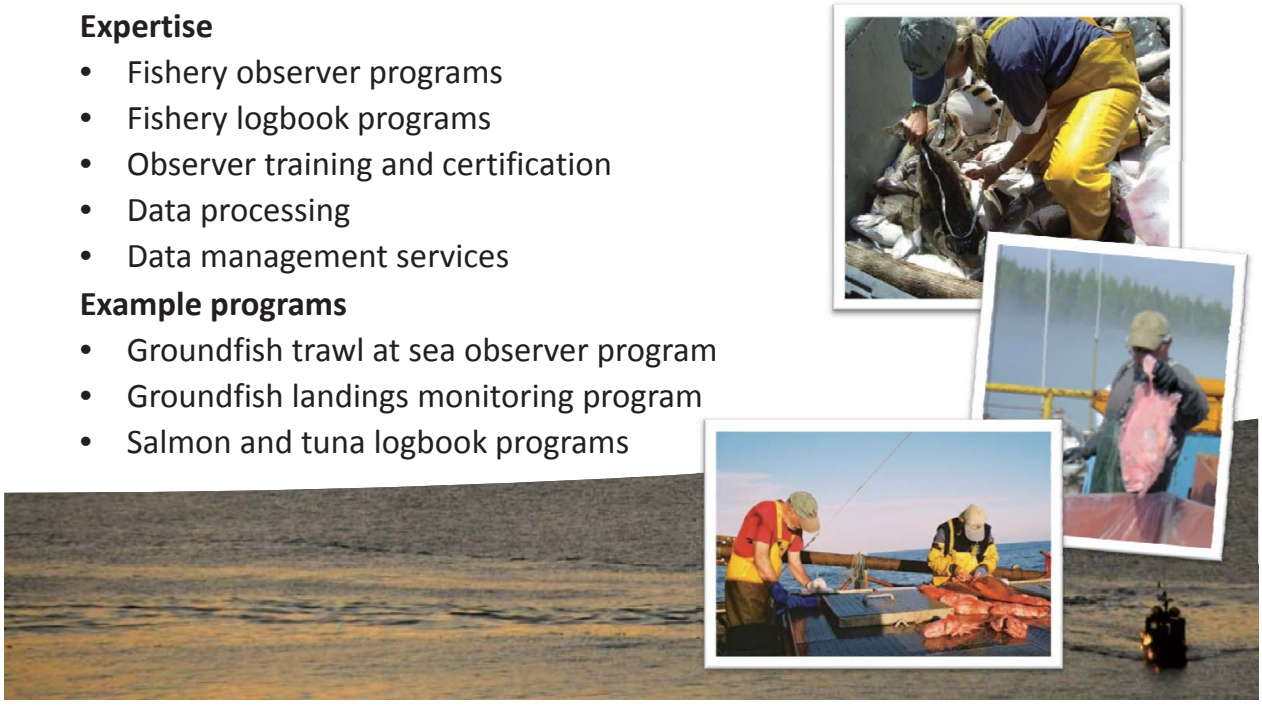
Fisheries Observer Programs

Expertise

- Fishery observer programs
- Fishery logbook programs
- Observer training and certification
- Data processing
- Data management services

Example programs

- Groundfish trawl at sea observer program
- Groundfish landings monitoring program
- Salmon and tuna logbook programs



Electronic Monitoring Programs

Expertise

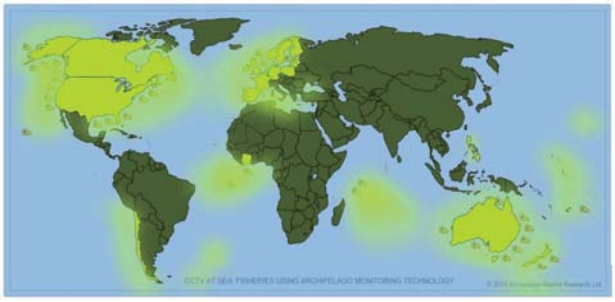
- EM technology development
- Monitoring program design
- Program implementation
- EM system provision and installation
- Data management, analysis, and reporting
- Capacity building and training

Example projects

- BC groundfish fishery
- Australia e-monitoring program
- US west coast and Alaska groundfish fisheries
- Numerous pilot studies

Archipelago's EM Experience

- Pioneered EM technology in 1999
- Introduced new EM Observe v5 monitoring system in 2015
- Offers a complete 'end to end' product and service focus
- Consulted on several EM program-design projects
- Launched 30+ pilot projects worldwide
- Overseeing seven fully implemented (turn key) EM programs, including pelagic longline fishing
- Deployed ~600 Archipelago EM systems, monitoring ~30,000 fishing days per year



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Key Advantages of EM

- Not limited by vessel size
- 24/7 data collection
- Less intrusive and less costly than observer programs
- More scalable than observer programs



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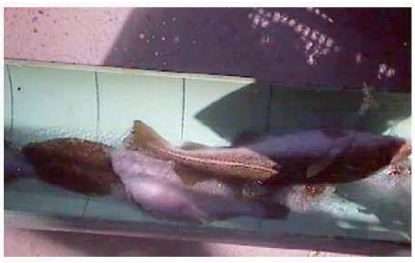
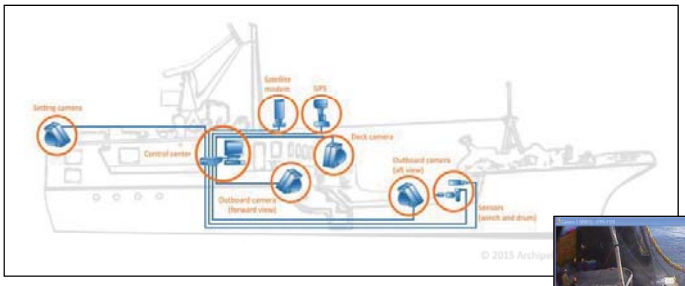
Key Challenges with EM

- EM is not tamperproof
- Technology can fail
- Requires fishing vessel support
- Complex program infrastructure
- 2-3 year implementation timeline

EM Technology

At-sea monitoring system



Encrypted sensor and image data

Land-based analysis system

Reviewed and annotated fishing-activity records

Fishery data

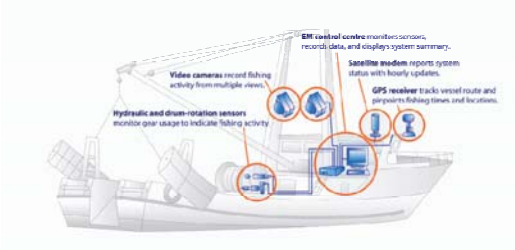
At-sea Monitoring System

Product:

- EM Observe control centre
- Sensor and camera inputs

Features:

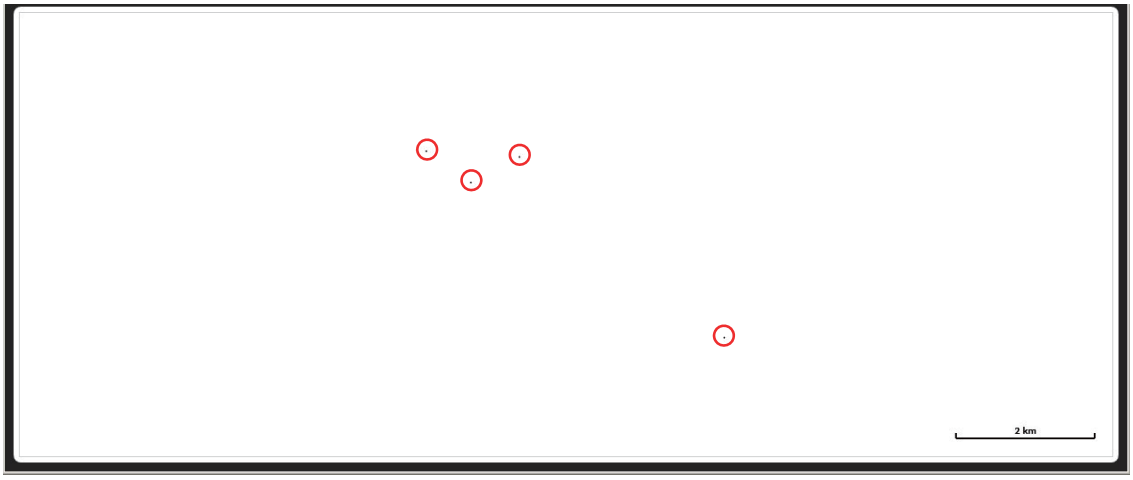
- Ruggedized for marine environment
- High system reliability
- Power management
- Fault tolerance and tamper evident
- User interface with function testing
- Multiple camera inputs
- Multiple sensor inputs (digital and analog)
- Continuous sensor recording
- Multiple recording triggers, including manual
- High capacity data storage
- Data encryption
- Satellite communication



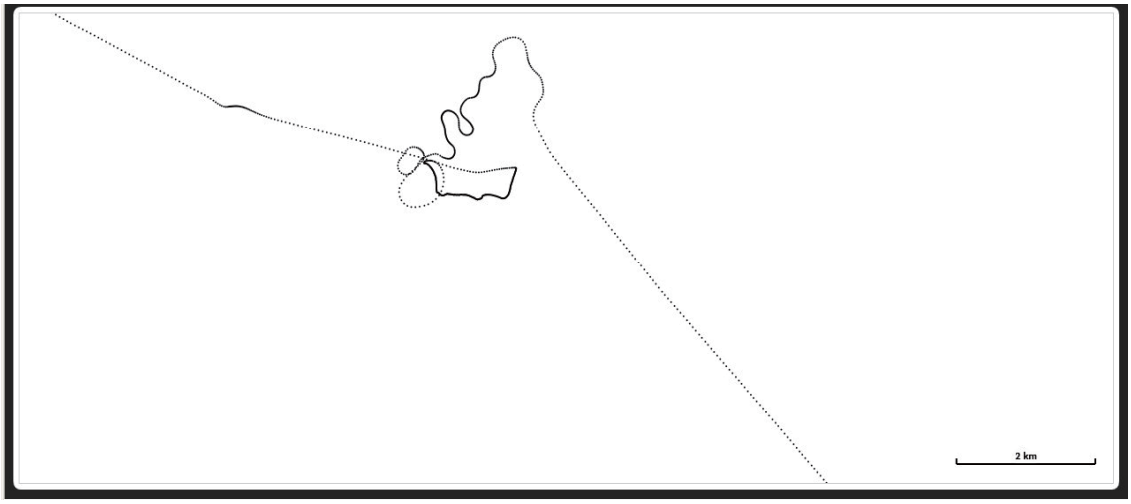
Camera Imagery

- All installations use digital IP cameras
- Most installations require multiple cameras
  - Control points
  - Context views
- Image quality dependent on:
  - Field of view
  - Number of images per second
  - Resolution
- Image data files are large! – ~600Mb/hr/camera

VMS (hourly frequency)



EM Sensors (10 sec frequency)

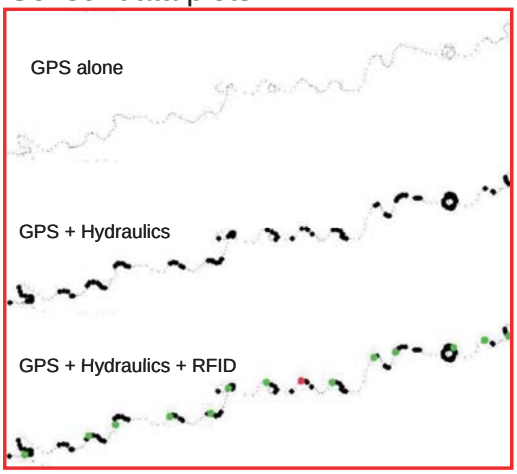


Multiple EM Sensors

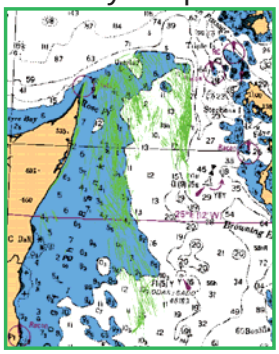
RFID tags

Tag scanner

Sensor data plots

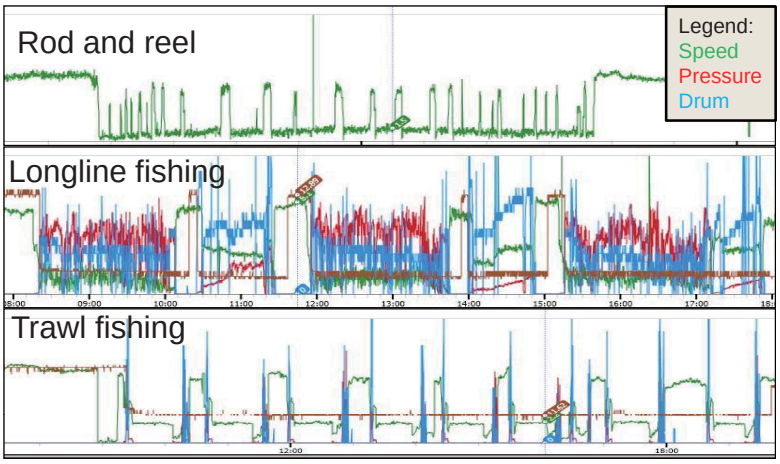


Fishery footprint

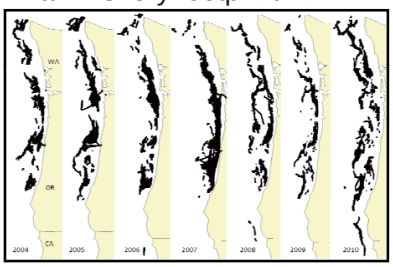


(Annual effort for 50 vessels, 32,000 traps, 450,000 trap hauls)

Vessel Activity Signatures



Trawl fishery footprint



Satellite Communications

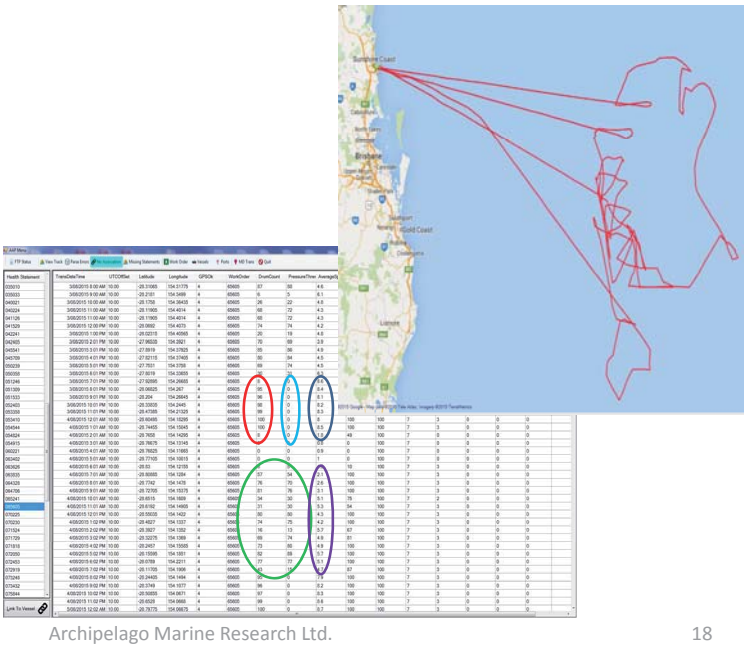
From Vessel (hourly):

- Vessel ID
- Time and date
- Position
- Sensor events
- Video status
- Data storage capacity
- System faults

To Vessel (on demand)*:

- Data polling
- System maintenance

* New in 2016



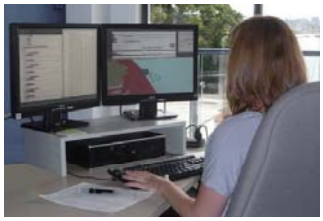
Land-based Analysis Software

Product

- EM Interpret Pro software

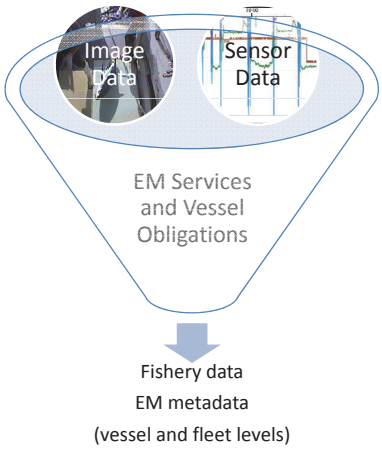
Features

- Workstation-based software tool
- Configurable desktop display
- Synchronized display of:
  - sensor data in time series and spatial format
  - multiple image streams
- Navigation and playback features
- Configurable data entry formats
- Auto detection of fishing events
- Easily exported data



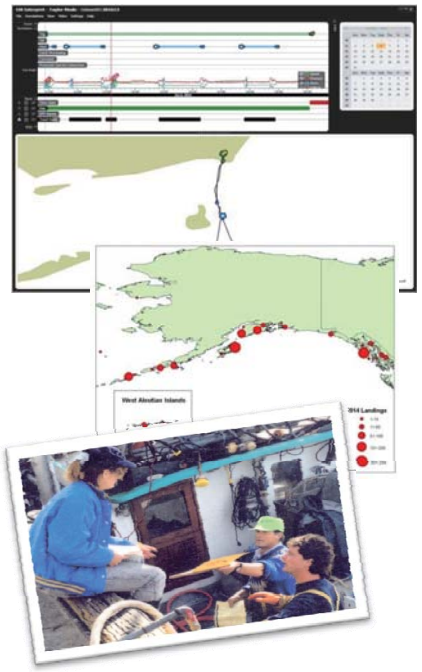
Putting EM to Work

The EM 'Iceberg'



Program Services

- Program management layer
  - Logistics
  - Stakeholder engagement
  - Optimizing speed, quality and cost
- Field services
  - Installation/servicing/data collection
  - Vessel obligations support
- Data analysis services
  - Data processing/reporting/feedback
  - Vessel obligations support



Vessel Obligations

- Ensure EM system is operating (no data gaps)
- Perform regular system maintenance (wires secure, clean cameras, etc.)
- Follow catch-handling protocols:

Low

High

Vessel Monitoring Plan (VMP)

- VMP purpose
  - Define monitoring objectives
  - Specify information needs required of EM
- EM technology specifications
  - Sensors, cameras, etc.
  - Installation specifications
  - Data-collection specifications
  - Performance specifications
- Vessel crew support responsibilities
  - EM system monitoring/maintenance
  - On-board catch-handling specifications
  - EM program communications requirements
- Other reporting obligations
  - Fishing logbooks
  - Landings data

EM Program Design

Program design goals:

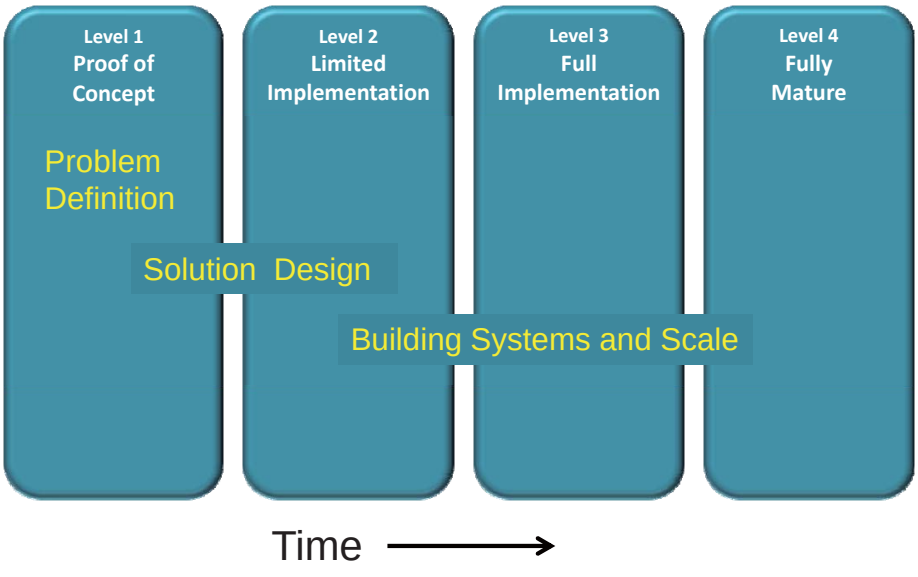
- Meets information needs
- Within budget
- Technically and operationally feasible

Program Setting:
- Available funds
- Monitoring objectives
- Fishery characteristics
- Monitoring design
- Program delivery

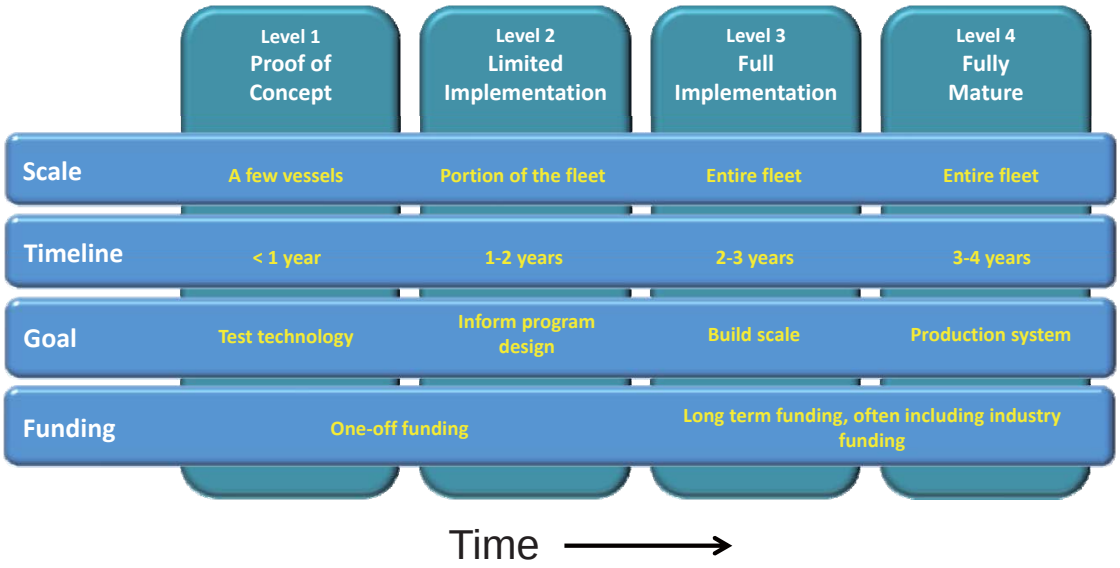
Common Design Pitfalls

- Substitution mindset (EM is not a 'plug and play' replacement for observers)
- Technology-centric planning (over-emphasis on technology rather than a more balanced program planning approach)

EM Program Maturity Stages /1



EM Program Maturity Stages /2



Opportunity Assessment for Pelagic Longline Fisheries

Opportunities

- EM technology is proven, and in use in Australian pelagic longline fishery
- EM is a more scalable monitoring solution than observers
- EM can help achieve 5% coverage level requirements

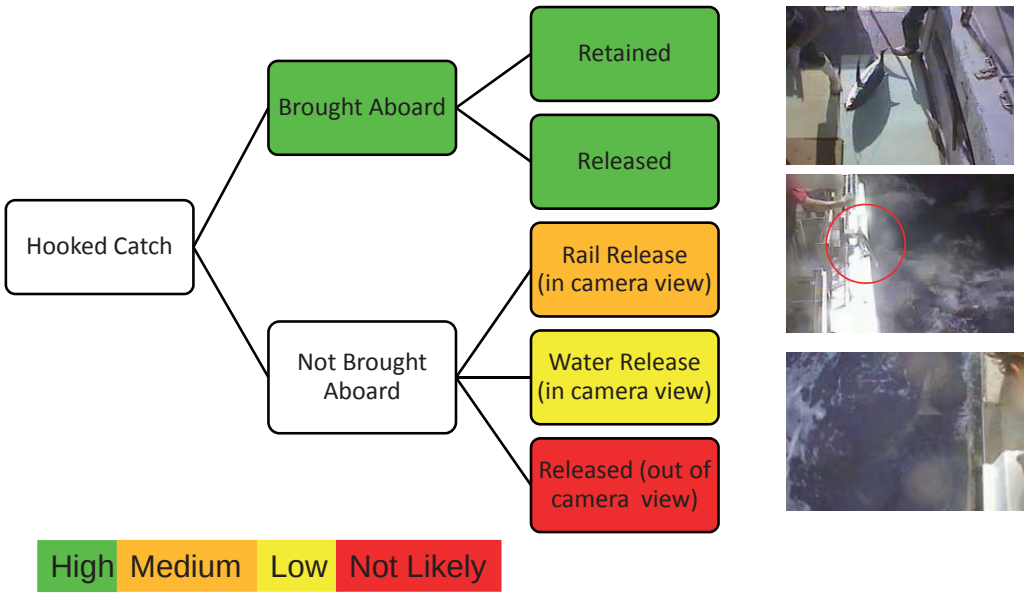
Key decision points:

- Data specifications
- Program scale
- Infrastructure requirements
- Vessel obligations

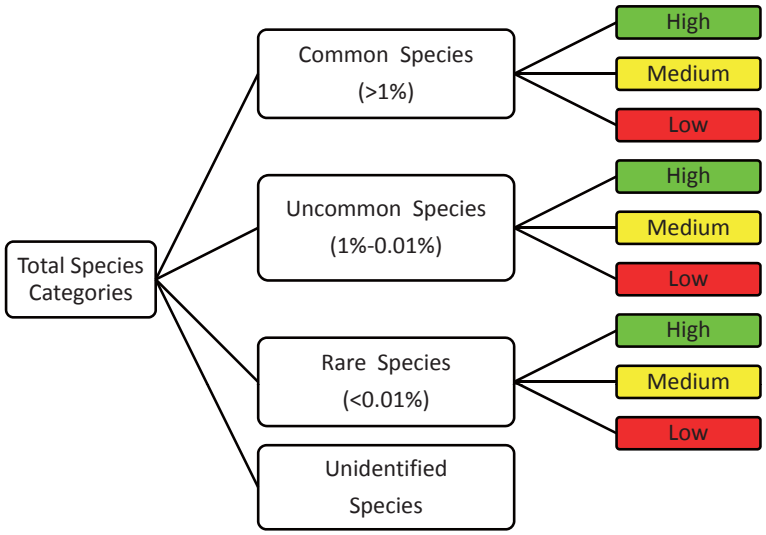
Data Specifications

Type of Information	Vessel Crew Effort	Analysis Effort
Vessel Location (VMS data)	Nil	Low
Fishing Location	Nil	Low
Fishing Effort (total sets)	Low	Low
Fishing Effort (total hooks)	Low	High
Mitigation Compliance (tori lines)	Low	Low
Retained Catch Accounting	Low	Medium
Discard Accounting (deck)	Medium	Medium
Discard Accounting (rail)	Medium	High
Discard Accounting (water)	High	High

Catch Detection Likelihood



Which Species are Important?



Other Decision Points

Field Services

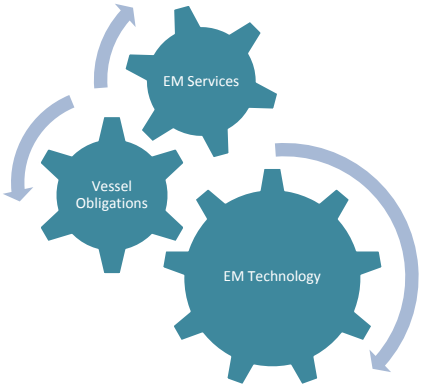
- Service locations
- Activity levels
- Technician availability

Data Services

- Service locations
- Data volume
- Analysis requirements
- Response timelines

Vessel Obligations

- Willingness to cooperate
- Catch handling requirements



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Conclusions

- Archipelago is a leader in EM technology and has successfully deployed EM programs in seven fisheries
- Our EM technology is proven across a wide range of fisheries, and we understand the implementation requirements of pelagic longline fisheries
- Archipelago is using EM in the Australian pelagic longline fishery, and has the capability to develop an EM program for Pacific pelagic longline fleets