Technology for MPA Monitoring

BLUE MARINE FOUNDATION

Satellite monitoring
Detects distant vessels

Drones
Aerial surveillance

Electronic monitoring
Onboard cameras

Shore-based radar
Nearshore surveillance

Managment platforms
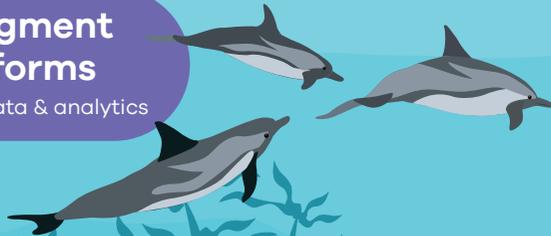Integrated data & analytics

Vessel tracking (VMS)
Tracks small boats

Uncrewed vessels
Autonomous patrols

Acoustic sensors
Detects vessel noise

Type	Management Platforms	Satellite Monitoring	Shore-based Awareness	Vessel Tracking (VMS)	Electronic Monitoring (EM)	Acoustic Sensors	Drones	Uncrewed vessels
Best uses	Integrates and visualises real-time data from multiple sources on a single dashboard. Enables detection of illegal fishing activities. Facilitates coordination of enforcement patrols. Supports analysis of spatial trends for adaptive management. Enhances community engagement and reporting for conservation outcomes.	Provides real-time vessel detection and activity monitoring through satellite-based AIS and radar data. Helps identify potential IUU fishing activity and incursions into MPAs. Can track compliance of MPA regulations and support adaptive management decisions.	Detects nearshore vessels using radar and AIS, ideal for areas with poor satellite coverage. Integrates with patrol operations and management platforms for coordinated enforcement response. Complements satellite monitoring by covering small-vessel activity and AIS gaps.	Tracks vessel positions via satellite or cellular to ensure compliance with MPA boundaries. Provides near real-time monitoring for quick detection of incursions. Enables analysis of fishing effort patterns around MPAs for adaptive management. Integrates with electronic monitoring and management systems for comprehensive surveillance. Acts as a deterrent to IUU fishing through mandatory reporting.	Monitors vessel activity and gear use within or near MPAs using onboard cameras and sensors. Verifies compliance with MPA regulations, such as no-take zones and gear restrictions. Provides video and positional data for enforcement. Enables resource management through detailed catch and bycatch data analysis.	Identifies engine/propeller noise and gear deployments in an MPA without the need for AIS. Can operate 24/7 across a range of weather conditions. Can inform patrolling efforts Can capture biological data alongside MPA enforcement.	Can be rapidly deployed for surveillance and data collection. Captures high-resolution imagery to identify vessels and activities. Can provide wide coverage of large or inaccessible areas without physical patrols and operate BVLOS. Monitors in real-time through live data streaming.	Can provide persistent presence for longer duration patrols. Covers large areas efficiently with remote operation. Collects multi-sensor data including video, radar, and acoustic signals. Enables real-time monitoring and data transmission to enforcement teams. Operates in challenging or hazardous conditions.
Limitations	Potential connectivity challenges in remote areas. Reliance on external sensors/ integrations for accurate data. Complexity of integrating multiple data streams. Technical capacity and resources for setup and maintenance required, with effective training key for implementation success.	Tools reliant upon AIS transmission which can be turned off by vessels during IUU activities. Non-AIS methods of satellite-based remote sensing are affected by weather (i.e. clouds) and temporal/spatial resolution coverage (i.e. return rate, swath). High resolution satellite imagery is expensive but Skylight offers this free of charge to MPA managers.	Limited to coastal zones and cannot monitor offshore marine areas. Expensive set-up and ongoing costs. Requires training to operate and trouble shooting.	Data is transmitted at intervals, not always real-time, which can restrict the extent of information that is gathered. Units can be tampered with or disabled by vessels if IUU fishing activity is taking place. Requires infrastructure and trained personnel for monitoring.	Requires reliable power and connectivity, which can be challenging in remote MPAs. High initial cost for hardware and ongoing expenses for data review and storage. Limited effectiveness for small vessels and reliant upon effective camera placement or sensor coverage. Fishers may resist adoption due to privacy concerns or perceived surveillance.	Depending upon how the array is set up there can be acoustic blind spots. Sound can be confounded by external noises (shipping traffic) or impacted by bathymetry. Requires specialised set-up procedures and ongoing maintenance.	Limited flight time and range due to battery constraints. Can be weather-dependent and can be restricted in strong winds or heavy rain. Requires reliable skilled operators and regulatory compliance. Can face signal loss or connectivity issues in remote areas.	Can have limited endurance compared to larger manned vessels for very long missions. Vulnerable to very harsh sea conditions and may need retrieval during storms. Require reliable communication links, which could fail in remote areas. Can be costly to procure and maintain. May face risks of collision or inter-ference from other vessels/ ocean users.