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MPA Sentinels: Leveraging Marine Monitor (M2) to support enforcement and compliance within California's Marine Protected Area Network

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Author

Wisener, Greg

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MPA Sentinels: Leveraging Marine Monitor (M2) to support enforcement and compliance within California's Marine Protected Area Network

Capstone Project

Greg Wisener
Master of Advanced Studies, Marine Biodiversity and Conservation
Scripps Institution of Oceanography, UC San Diego
June 9, 2026

Capstone Advisory Committee
Katie O'Donnell, WILDCOAST
Samantha "Sam" King, ProtectedSeas
Anastasia Cervantes, California Marine Sanctuary Foundation
Samantha Murray, JD, Fish and Game Commission, Scripps Institution of Oceanography, Chair

Deliverables viewable here: <https://bit.ly/M2Guides>



Signatures

Katie O'Donnell:

A black rectangular box redacting the signature of Katie O'Donnell.

Date: June 12, 2026

Samantha King:

[Samantha King \(Jun 11, 2026 17:28:32 EDT\)](#)

Date: June 11, 2026

Anastasia Cervantes:

[Anastasia Cervantes \(Jun 12, 2026 12:42:41 PDT\)](#)

Date: June 12, 2026

Samantha Murray:

A handwritten signature in blue ink, appearing to read 'Samantha Murray'.

Date: June 12, 2026

Abstract

This report is useful for any leader interested in supporting marine enforcement and compliance within Marine Protected Areas (MPAs). The project synthesizes and shares best practices, insights, and ideas of marine conservation professionals who are adept at working together to lead enforcement and compliance effort for California's extraordinary network of MPAs. The project's focus is on Marine Monitor (M2) technology, provided by ProtectedSeas, and how it can best be used to support the work of California's Department of Fish and Wildlife (CDFW) wildlife officers and allied agencies, regarding MPA enforcement. Deliverables contained in this report will be useful for enforcement officers, team members at ProtectedSeas, M2 Site Partners including team members of the California Marine Sanctuary Foundation (CMSF) and WILDCOAST, members of the MPA Collaborative Network, or decision makers from funding organizations like the Resources Legacy Fund (RLF), California's Ocean Protection Council (OPC), and other organizations. Deliverables include a M2 Site Selection and Readiness Guide, M2 Pro-Tips for Enforcement Officers, and an M2 Site Partner guide for structured feedback from enforcement officers. M2 is currently adding value, and in the future it can provide even more. This report is intended to help leaders continuously improve M2's support for MPA compliance and enforcement.

Introduction and Background

Along California's often rugged 1,100 miles of coastline, the state has embarked on a bold initiative to preserve the tremendous biodiversity of marine life that have called these chilly waters home for millennia. Leaders have set aside 124 Marine Protected Areas (MPAs), in a network that is ecologically linked, to ensure that future generations of people, and of life in the sea, will have the opportunity to coexist together. The success of this globally recognized endeavor depends upon many thousands of commercial and recreational fishers making a choice not to take from these places that, by design, will have the best catch. Many comply voluntarily, because they know it is the right thing to do and they want their children and grandchildren to enjoy the same ocean life that they do. Some will comply only if their fear of consequences compels them to stay away. This is the challenge facing the California Department of Fish and Wildlife (CDFW) Marine Enforcement District and the allied agencies that support them. CDFW has only 50 wildlife officers and 7 patrol boats dedicated to maritime enforcement. Their patrol area covers the entire coast with a jurisdiction that reaches out to 200 nautical miles. They enforce a complex and varied set of fish and game regulations that require their presence on land including inspection of seafood where it is sold, in estuaries, along the inter-tidal zone, in coastal waters, and further offshore. These wildlife officers are exemplary law enforcement professionals, able to make the most of limited resources while relying on their local network within maritime communities and their own observations to know when to be where. But, these

ocean guardians are too few and they have limited time to patrol MPAs. CDFW has a well-documented shortage of enforcement officers and vessels. According to the Service Based Budgeting Analysis completed for CDFW in 2021, the enforcement branch is operating with only 33% of the Wildlife officers and supporting resources needed to meet mission requirements across the state (CDFW, 2021).

Recognizing the extraordinary challenge facing CDFW wildlife officers and their allies, the conservation professionals at the Resources Legacy Fund (RLF) partnered with several other organizations to offer support. Since 2015, a system called Marine Monitor (M2), produced by ProtectedSeas, has been deployed to 9 locations in support of MPA enforcement and compliance. The Santa Barbara Channel area currently has 3 M2 sites, supported by Site Partners at the California Marine Sanctuary Foundation (CMSF). The San Diego County area also has 3 M2 sites, supported by Site Partners at WILDCOAST. In both areas, the system is used frequently by some CDFW wildlife officers, allied agency officers, and other M2 users to provide shared awareness of vessel activity, including boats and personal watercraft, within and around MPAs. M2 information has provided support for patrol planning, investigations, and citations for warnings, violations, and prosecutions for violation of MPA regulations (Wertz et al., 2022).

M2 is designed to cover a range of at least five nautical miles (nm) from the site where it is physically located. M2 sensors include RADAR, camera, and an Automatic Identification System (AIS) receiver. M2 can also be networked with Global Fishing Watch and other remote sensing data. M2 fills an information gap by tracking the large number of small vessels that can support fishing but are not required to transmit AIS or Vessel Monitoring System (VMS) data. The system is intended to operate 24 hours, seven days a week and offers an M2 Viewer with mobile and desktop versions, as well as real-time alerts of vessel tracks of interest (ProtectedSeas, 2022). Where M2 systems have been deployed, there is enhanced awareness of local ocean use. In some cases, this information has strengthened enforcement and significantly improved compliance. But in other cases, M2 data and other observations show persistent hot spots of suspicious activity despite the increased awareness provided by M2.

This project explores how M2 can best be used to support enforcement and compliance and how its use may be expanded to cover MPAs where resource managers and enforcement officers believe M2 will be the most helpful. Based on a listening tour with dozens of leaders who focus on the San Diego and Santa Barbara Channel MPAs, this project resulted in the production of three deliverables. The first captures and shares “pro-tips,” the best practices of officers who have incorporated M2 into all aspects of their MPA related work. The second is a guide for ProtectedSeas and Site Partner team members to help them conduct structured, periodic feedback sessions with officers to know what is working well and what is hindering full use of M2 information. The third is a guide for leaders who are exploring possibilities for deploying M2 to new locations, to monitor vessel borne activity in and around MPAs.

Problem Statement

A high-level look at the history of M2 within the California MPA network suggests that this capable maritime domain awareness tool may be undervalued and underutilized. The M2 systems were first introduced 11 years ago, and the number of systems has not appreciably changed since initial pilot deployment in 2015. In fact, some locations have been demobilized, and the now aging hardware at remaining sites is not always the latest and greatest that ProtectedSeas has to offer. The 2022 MPA Decadal Management Review (DMR) mentions that M2 has been helpful but appropriately recommends that the state's limited resources first go towards providing much needed additional wildlife officers as a higher priority than investing state resources in M2, which the DMR describes as "an expensive tool to maintain" (Wertz et al. 2022).

Leaders from WILDCOAST, CMSF, and ProtectedSeas report success in adoption of M2 technology into the day-to-day work of some officers, but not others. These Site Partners, along with the MPA Collaborative Network and other organizations, do what they can to support officers with MPA enforcement training, including how to access and use M2 information. But, they recognize that MPA enforcement is one of many priorities for CDFW and allied agencies and that M2 is one among many systems and tools that these officers need to manage while maximizing their time on patrol. Clearly, M2 use has to be "high speed and low drag" for officers operating in the often challenging maritime environment.

Methodology

Given access to the vibrant professional networks of the advisory committee, this capstone project is informed by discussions with dozens of experienced marine conservation leaders who generously gave of their time. Conversations focused on the current state and possible future of M2 support for MPA enforcement and compliance. Site Partners and officers described how they use M2 for various tasks to gain awareness and insight in real time, and through recorded data. Several wildlife officers were interviewed in each geographic area along with allied agency officers. The San Diego City Attorney's office considers MPA enforcement a priority, and they provided valuable perspective regarding the use of M2 for real time observations and case file support. The Resources Legacy Fund supports M2 financially, and their perspective as a funder also provided valuable insight. The MPA Collaborative Network provides MPA enforcement training and offered consistently valuable insights. Input from the Capstone Advisory Committee was essential in understanding the perspectives of Site Partners and ProtectedSeas as the M2 service provider. ProtectedSeas facilitated discussions with M2 Site Partners in Mexico. This cross-border conversation reinforced that the shared awareness M2 provides is the most valuable benefit of M2's real time information and historical data, because shared understanding of what is happening on the water clarifies enforcement and compliance goals, leading to action.

Findings: Current State

M2 could be used by more officers, more frequently. There are exemplary “power users” who build M2 into their work, and there have been landmark cases in which M2 has been an important data source. However, there are also officers who do not use M2 or use it infrequently. Perhaps because of limited use, feedback is rare and so it is hard for ProtectedSeas and M2 Site Partners to know what is working well and what should be improved to better support busy officers (ProtectedSeas, 2022).

Because there are only a few MPAs covered by M2, the value of logging in and using the M2 Viewer may be lessened, especially in the minds of wildlife officers who have a massive area to patrol and may not be near the covered area for several days. On the other hand, having a cluster of M2 in each area has been helpful to wildlife officers in deciding when to patrol there. For example, the Lieutenant commanding the patrol boat in Ventura will normally check the M2 at Anacapa Island and another near Santa Barbara to decide when it makes the most sense to expend time and fuel to transit there. Wildlife officers in San Diego use M2 to decide whether to start their daily patrol in the north or south of the county.

Finding physically suitable places, with willing site hosts, and a clear permitting path has proven difficult for the non-governmental M2 partners. Several M2 sites have been demobilized because the landowner decided not to host the system. Other locations would clearly benefit from M2 coverage, but the lack of a landowning site host or the difficulty of the permit processes have prevented installation. Safeguarding ecosystems within the MPAs adjacent to their land is not always a landowner’s priority. An M2 system may disturb the aesthetics of a place or attract unwanted attention. As a result, M2 sites tend to be where there is an amenable landowner instead of where the system can offer the most value.

Findings: Future Vision

In an optimal future, leaders will view M2 as an important extension of each wildlife officer’s sensors and observational capabilities. Every shore adjacent MPA that has a significant risk of illegal take from a vessel will be covered by a reliable, high quality M2 system. This could require as many as 15 to 20 M2 systems in the Southern California region alone. In this desired future, landowners are willing to host a site for many years, especially those that are governmental partner agencies like the national and state parks.

In this desired future, every officer responsible for MPA enforcement will be a frequent, competent user of M2. They will receive accurate, relevant alerts when on duty, but will not be hassled by them when off duty. Each of those officers will frequently access the M2 Viewer and will be adept at using it for both real time observation and in producing reports to reveal patterns

of suspicious behavior. The M2 Viewer will meet officer's needs or if not, officers will communicate with ProtectedSeas and their Site Partners to let them know what is not working. ProtectedSeas will have the resources to respond to feedback from the field, making improvements quickly. Regularly scheduled maintenance and upgrades will provide reliability, and repair times will be expedient.

In this future, M2 will become a source of shared awareness among all concerned with enforcement and compliance. Resource managers will use M2 data to understand vessel borne human activity on the water. Prosecutors and judges will understand and value M2 data for its reliability and quality. Since successful prevention is hard to measure, the quality of shared information about vessel activity in and around MPAs will be the measure of effectiveness for M2 deployments. Enforcement success will be measured by a reduction in the number of tracks of interest, as fewer and fewer vessels will behave in a way that suggests they are fishing illegally. Success will include a high-fidelity alert system that rarely has to be used because compliance rates are high.

Deliverables

This report offers three deliverables to close the gap between the desired future state and our current state of M2 support. The first deliverable is designed to share the best practices of “power user” officers with other law enforcement professionals so that today's exemplary level of performance will become tomorrow's expected level of performance setting a new, higher standard. The second deliverable is for the use of M2 Site Partners and ProtectedSeas staff to periodically interview officers and ask structured questions to find out how M2 provides ideal support and how it is falling short. The third deliverable is designed to generate thoughtful collaboration among leaders of partner organizations who are considering investing time, effort, and money in deployment of M2 to a new location. These three deliverables are:

- M2 Site Selection and Readiness Guide
- M2 Pro-Tips for MPA Enforcement
- M2 Site Partner Guide: Structured feedback from officers

Conclusion

Success, in marine enforcement and compliance, depends upon effective human interactions. Officers from CDFW and allied agencies are skilled in engaging the maritime public to educate, inform, convince, warn, or hold accountable would-be and actual violators of MPA regulations. M2 can and should serve to assist officers in being in the right place, at the right time to make contact, engage, and do the work they do so well. It can and should support resource managers as they develop targeted campaigns to build a sense of ownership and advocacy among the boating and fishing public. The optimal state of M2 support is possible, and the deliverables provided in this report can help shape a “voyage plan” to achieve that bright future.

Appreciation

This project was directly supported by many leaders who gave their time and attention. I am tremendously appreciative of them all and feel fortunate to have been included in this extraordinary community of dedicated professionals. They include:

<u>ProtectedSeas:</u> Samantha “Sam” King (Advisory Committee) Brendan Tougher Bryant Irawan <u>California Marine Sanctuary Foundation:</u> Anastasia Cervantes (Advisory Committee) Jessica Morten <u>WILDCOAST:</u> Katie O’Donnell (Advisory Committee) Lillie Mulligan <u>Scripps Institution of Oceanography, UCSD:</u> Samantha Murray, JD (Advisory Committee Chair) Hannah Tannenbaum (MAS MBC Program Manager) Steve Bennett (Presentation Advisor) <u>Resources Legacy Fund:</u> Kaitilin Gaffney, JD Liz Parissenti <u>MPA Collaborative Network:</u> Calla Allison Aubrie Fowler <u>Santa Barbara Channelkeepers:</u> Penny Owens	<u>Cal Dept of Fish and Wildlife Marine Enforcement:</u> Assistant Chief Eric Kord Captain Daniel Lengning LT Scott Cohen LT Clark McLennan LT Austin Smith <u>Allied-agency Officers:</u> Ranger Merrill McCauley (NPS) Officer Tim Gunther (CA State Parks) Bernice Villanueva-Grzecka (Dana Point) <u>Cal Fish and Game Commission:</u> Samantha Murray, JD (Commissioner) <u>San Diego City Attorney’s Office:</u> Scott Frazee, JD Arya Sadighian, JD <u>Global Conservation:</u> David Bess Michael Stefanak Alex González <u>Pronatura Noroeste:</u> Xóchitl Rojas Lagunes <u>Ocean Protection Council:</u> Staci Lewis, PhD
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Marine Monitor (M2) Site Selection and Readiness Guide

Decision Support Tool for Safeguarding California's
Network of Marine Protected Areas



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INTRODUCTION

This guide is designed as a first step for Marine Protected Area (MPA) partners seeking to make best use of Marine Monitor (M2) technology to support MPA enforcement and compliance effort. Structured questions facilitate collaboration among partners who share responsibility for one or more MPAs. The questions inform deployment decisions via two assessment tools:

- M2 Site Selection (“Go”, “No-go”, and “Not Yet” criteria)
- M2 Partner Readiness (Site-specific Strengths, Weaknesses, Opportunities, Threats)

These tools are meant to provide decision makers with information needed to make best use of limited time and money by deploying M2 at sites where it will provide the most value. The guide can also help project leads to develop goals and a worklist to prepare for M2.

BRIEF HISTORY OF M2 IN CALIFORNIA

Since 2015, thanks to the leadership of partner organizations, M2 systems have been deployed to provide continuous observation of vessel traffic within a small number of California’s 124 MPAs. Currently, the Santa Barbara Channel is covered by several sites including the Channel Islands, Santa Barbara coastal MPAs, and MPAs in a more remote coastal area. San Diego county also has several M2 sites in areas with heavy vessel traffic, near multiple ports. Central and Northern California have some M2 coverage in both heavily trafficked and more remote areas. Although results have varied depending on circumstances at each site, M2 has proven to be a valuable coastal sensor in support of wildlife officers, partner agencies, and non-governmental organizations that support MPA enforcement. This guide leverages lessons learned to enable effective collaborative decisions focused on where and why to deploy M2.

WHAT IS M2

Produced by marine conservation professionals at ProtectedSeas, M2 systems track waterborne human activity that may otherwise be undetected and unreported. The system consists of an Automatic Identification System (AIS) receiver to detect vessels that transmit AIS data, a coastal RADAR for detection of all vessels, and a camera system co-located with the RADAR. It can be networked with Global Fishing Watch and other data sources. M2 technology is available at a low cost compared to other persistent, remote-sensing options. Even so, choosing to deploy M2 is a significant investment of time and money for preparation, installation, operation, user support, data analysis, maintenance, and repair. More information about M2 is available here: <https://m2marinemonitor.com/>

WHEN TO USE THIS GUIDE

Employ this guide when there is a perceived need to better understand, influence, and/or manage afloat human activity, aboard boats and other vessels, within and near an MPA.

WHO SHOULD USE THIS GUIDE

This guide is for leaders with responsibility for safeguarding one or more MPAs, including:

- Potential M2 site partners; these may include the California Marine Sanctuary Foundation (CMSF), the MPA Collaborative Network, coastal waterkeeper organizations, WILDCOAST, and others.
- California Department of Fish & Wildlife (CDFW) as the lead agency and partnering enforcement organizations responsible for MPA enforcement. Officers with the local knowledge needed to make best use of this guide include marine and land-based CDFW wildlife officers, park rangers, sheriff deputies, police, and others. Agencies allied with California Department of Fish and Wildlife (CDFW) include: California State Parks, National Park Service, the National Oceanographic and Atmospheric Administration (NOAA), the U. S. Coast Guard and other federal, state, county, and local allies.
- Funding organizations, including the Resources Legacy Fund (RLF) and Ocean Protection Council (OPC), who are considering initial and long-term funding for M2 deployments in support of California's MPA Network.



Figure 1: MPA enforcement workshop (Image provided by MPA Collaborative Network)

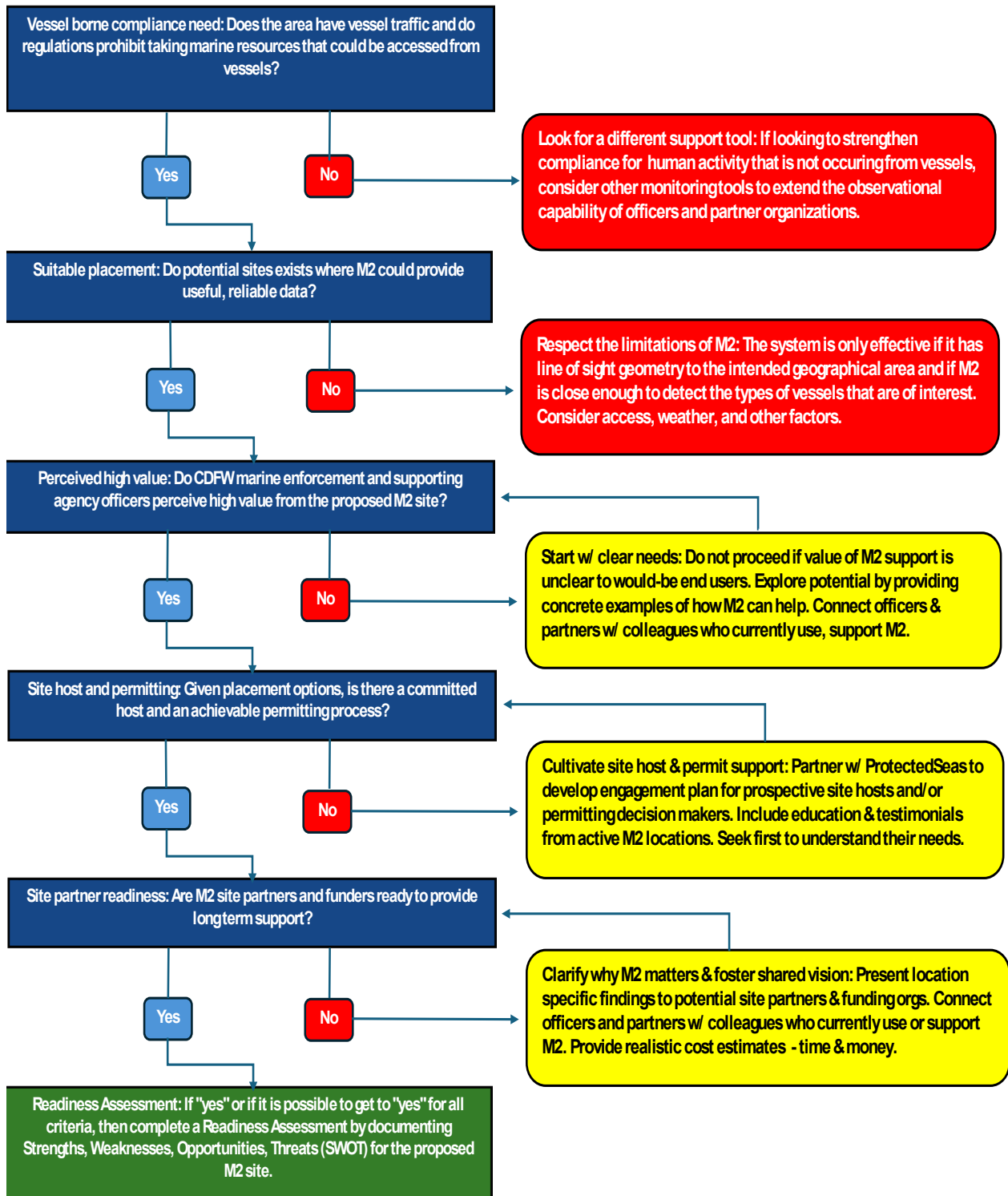
HOW TO USE THIS GUIDE

The guide is based on five criteria. The first two serve as “go” or “no-go” knockout requirements. There either is or is not a vessel borne compliance risk and there either are or are not suitable locations for the M2 system to cover the desired area. The next three criteria depend upon the assessor’s judgement, guided by a series of questions and discussion points.

The main point of the guide is to provide structure to facilitate meaningful discussions among conservation professionals. Collaborative partners can use the guide to assess how much value an M2 system can add and how ready they are to lead the way. There are note-taking areas available in each section of the guide.

The flow chart on the next page illustrates the structure of this guide.

M2 Site Selection Criteria



HOW M2 SUPPORTS ENFORCEMENT AND COMPLIANCE

The M2 system offers unique capabilities that can add tremendous value in support of organizations working to enforce or enhance compliance within MPAs. Review this section while thinking about how M2 might be used to:

- Provide shared awareness regarding frequency of boating and fishing
- Inform targeted campaigns for voluntary compliance
- Support enforcement effort to compel compliance
- Conduct research, monitoring, and analysis related to on-the-water human activity

M2 CAPABILITIES

M2 provides accurate positional data relative to MPA boundaries. In the right conditions, M2 provides images and videos to better understand and document the type of vessel being tracked, how it is being operated, what the people on board are doing, and what method of take may be in use. This information can be provided real-time via the M2 Viewer or via recorded data.

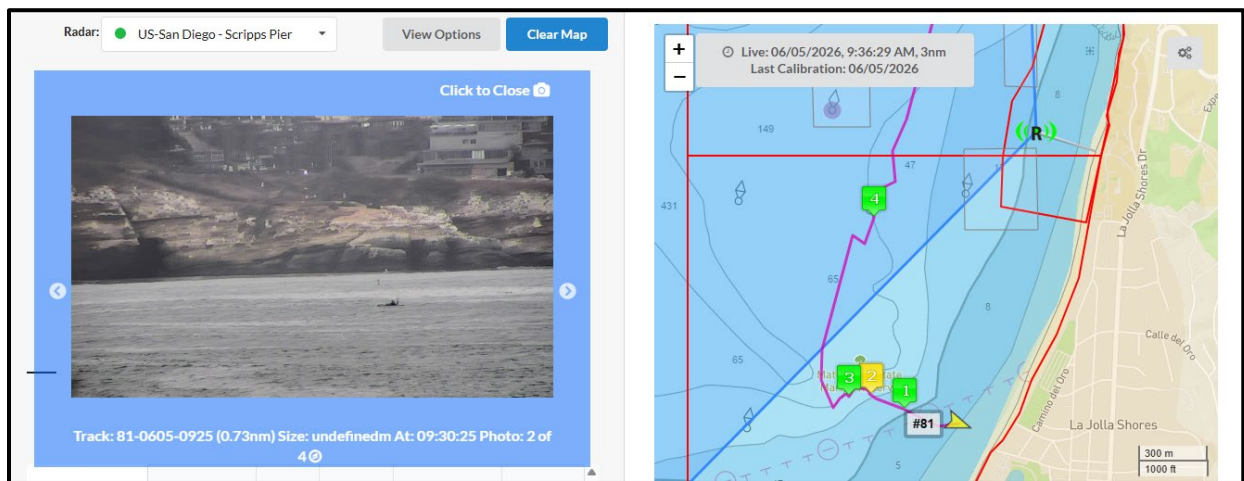


Figure 2: M2 Viewer showing possible fishing from kayak, image correlated to location data from radar (Credit: ProtectedSeas)

SUPPORT FOR CDFW AND PARTNER AGENCY MARINE ENFORCEMENT

Technology will never be a substitute for the presence of experienced law enforcement professionals, but M2 does extend their ability to observe and understand situations on the water. M2 can support the following tasks that MPA enforcement officers do every day:

- Patrol planning decisions (when to patrol an area)
- Surge planning decisions (when to send additional resources to an area)
- Awareness through real-time automated alerts
- Observation of vessels and people on board

- Tracking of vessels as they enter and leave an MPA
- Navigating patrol vessel(s) to intercept suspicious vessels
- Record geographic data and visual imagery before, during, and after officer contact
- Case file preparation to document MPA violations
- Investigation of suspicious activity

SUPPORT FOR PROSECUTION OF MPA VIOLATIONS

M2 data is useful for providing shared awareness and for strengthening the body of evidence regarding specific MPA violations. Reports generated from M2 data can be used to educate city attorneys, district attorneys, judges, and their staffs about the importance of providing accountability for MPA violations. Data can be prepared and validated as part of the case file documenting evidence related to specific cases, including evidence of repeat offenses by owners and operators of specific vessels.

MEASURES OF EFFECTIVENESS FOR COMPLIANCE

M2 data can be compared across years, months, weeks, seasons, and ecological events to gauge trends regarding compliance in and around an MPA. These comparisons can serve as measures of effectiveness for the total compliance effort including education and enforcement. M2 reports may compliment other methods of monitoring, including a community science program called MPA Watch that includes observation of human activity in and around MPAs.

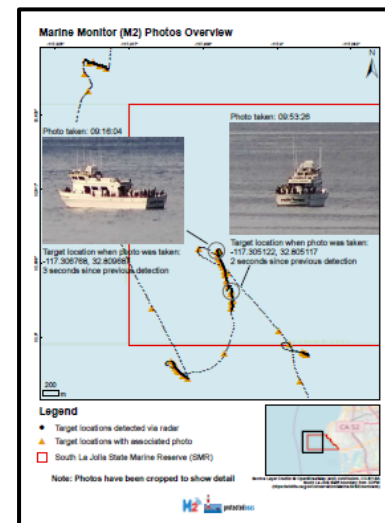


Figure 3: Case support from ProtectedSeas

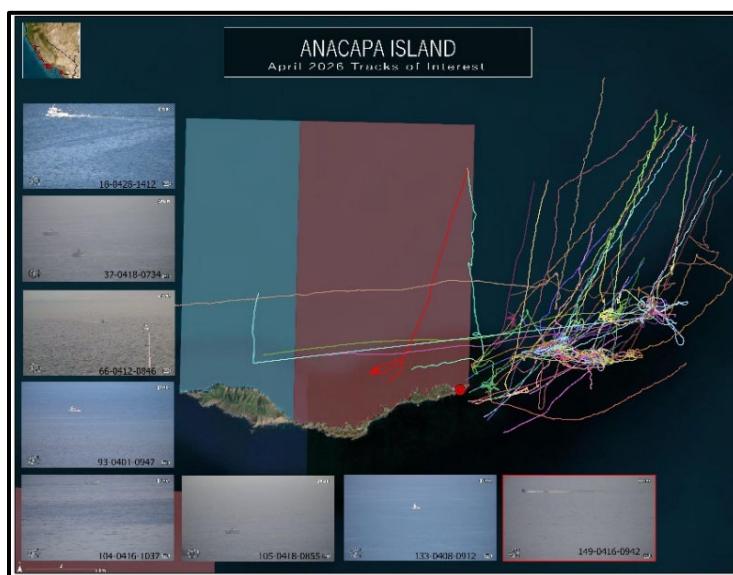


Figure 4: Excerpt from M2 site partner monthly report for April. Provided by California Marine Sanctuary Foundation

CRITERION 1: VESSEL-BORNE COMPLIANCE NEED

Criterion 1: Does the area have vessel traffic and do regulations prohibit taking marine resources that could be accessed from vessels?

Purpose: Use to determine whether investment in M2 makes sense for a proposed location.

Go or No-Go factors for vessel-borne compliance need	Yes	No
Does the MPA(s) have significant boating or other vessel traffic (ex: kayaking, stand-up paddle boarding)? - Generally, MPA should be coastal, not estuarine, and accessible by vessels.		
Does the regulatory level of protection prohibit the taking of marine resources that people normally access by vessels? - Summaries of regulations for each MPA are provided here: California Marine Protected Areas (MPAs) - California MPA levels of protection are defined here: MPA types		

Assessor's notes for compliance need:

Vessel traffic:
Regulatory level of protection:
Other:

CRITERION 2: SUITABLE PLACEMENT

Do potential sites exist where M2 could provide useful, reliable data?

Purpose: Use to consider whether a place has the right conditions for an M2 site.

Factors for suitable placement	Yes	Mostly	No
Geometrically suitable: Is there a clear line of sight from prospective M2 locations to desired coverage area?			
Access: Does the site offer timely access for installation, maintenance, and repair?			
Weather conditions: Given expected sea states and visibility, are ProtectedSeas specialists confident that M2 will provide useful data?			

DISCUSSION POINTS FOR SUITABLE PLACEMENT

Geometrically suitable: Most M2 site locations have some blind spots, or shadow zones, where a physical object blocks the sensor from seeing part of the ocean's surface. One example is the pocket coves common to rocky areas along the California coastline. Compare blind spots to location of areas where illegal take is likely. If key areas are not in shadow, then there is a clear line of sight from sensors to desired coverage areas.



Figure 5: Dana Point preserve, atop 320-foot-tall coastal cliffs. Nearshore waters are obscured by geometry of this site.

Access: How accessible are prospective M2 sites for installation, maintenance, repair? Can the site be accessed by vehicle? Other options?

Consult ProtectedSeas to assess how accessible a potential site location is.

Weather conditions: Assess expected system performance based on height of eye, expected distance to vessels of interest, radar cross section and composition of vessels, historical wind, wave, and visibility conditions for the proposed site.

OTHER CONSIDERATIONS FOR M2 PLACEMENT

Security: How secure is the site? What is the likelihood of tampering or vandalism of the M2 system? Can it be made more secure, if needed?

Power: Does the site offer connection to reliable shore-based power? If not, can a self-powered Mobile Marine Monitor (M3) system provide reliable power?

Connectivity: Does the site offer a data link via land line? Strong cellular data connection? If not, is satellite connectivity an affordable option?

Mobility: Could it be possible to move a trailered, solar powered M3 system between pre-sited locations in nearby MPAs? Consult ProtectedSeas for this use case.

Overlap: Could M2 coverage from this site overlap with coverage from another M2 system? Would that enhance the tracking capability of both systems?

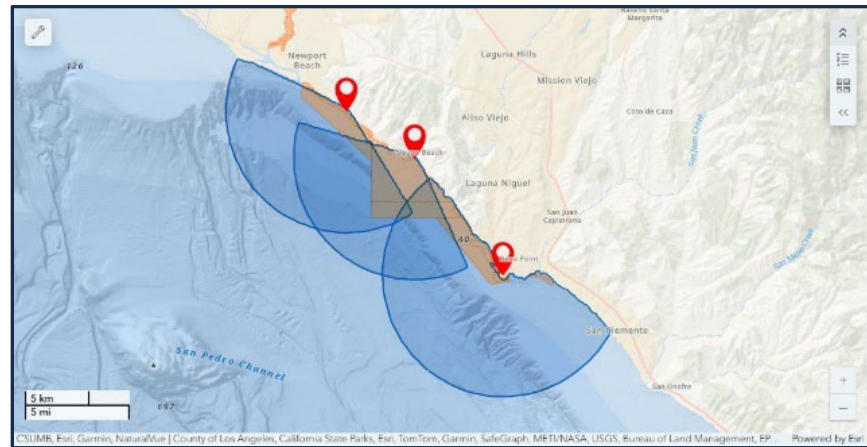


Figure 6: Viewshed of theoretical coverage of 4 MPAs between 2 Ports (Credit: Samantha King, ProtectedSeas)



Figure 7: Mobile Marine Monitor (M3) site in Channel Islands (Image: ProtectedSeas)

Assessor's notes for placement:

Potential site 1:

Potential site 2:

Other notes:

CRITERION 3: HIGH-VALUE EXPECTED BY END USERS

Do leaders from CDFW marine enforcement and supporting agencies expect high value from the proposed M2?

Purpose: Use to gauge how much “buy-in” end users have regarding M2, and why or why not.

Factors for M2 user expectations	Yes	Worklist Item	No
Given the M2 capabilities and data products described earlier, do leaders from CDFW marine enforcement and supporting agencies expect high value or have concerns about proposed M2, intended to support their overall effort? (<i>Record reasons why or why not.</i>) <i>Additional location specific discussion topics may include:</i> - How officers might use real-time alerts - How data may support planning - Local risk of illegal take (poaching pressure) - Transit time for patrol forces - Support for other marine conservation enforcement including fisheries, critical habitat, marine mammals - Would this location require customizing M2 to meet local needs? (<i>Examples include camera upgrades or sensors networked from multiple geographic locations.</i>)			

DISCUSSION POINTS FOR EXPECTED VALUE

Local risk of Illegal Take (Poaching Pressure): Based on available data, including local knowledge of MPA enforcement officers and others, discuss the likely risk of illegal take of marine resources (poaching pressure) in the proposed area. This risk, in part, is influenced by human population density with risk increasing proportionally to population. It is also influenced by the ease of access to MPAs, with those MPAs that require a short voyage in fine weather tending to be accessed more frequently than more remote MPAs with more challenging weather conditions. This risk varies by season, species, and marine ecosystems.

Transit-time for patrol forces: Some MPAs are easy to reach for enforcement patrols while others are remote and require many hours of low-value patrol transit time and high fuel consumption for patrol vessels or aircraft. Some areas have challenging seasonal weather conditions making transit to MPAs difficult. M2 systems may add value in both cases, either by alerting enforcement officers to nearby human activity for rapid response or by providing

historical data about vessel traffic density to help officers decide when to transit to distant MPAs. In this context, consider what added information M2 can provide to assist officers.

Customizing M2 to meet local needs: Could M2 be more useful with customization? Based on local geography, distances, and weather conditions, the proposed area may require modifications to the standard M2 system to meet local needs. This may include camera upgrades, networked cameras to provide multiple perspectives, and other solutions to cover the desired ocean areas.

Range Detail		
Detection	Confirm vessel presence	5 nautical miles*
Recognition	Recognize vessel type	3 nautical miles*
Identification	Identify specific vessel	1 nautical miles*

*Based on field observation of cameras with 30x zoom (note that higher zoom does not always directly relate to greater visibility distances, see IEC EN62676-4: 2015 International Standard)

Figure 8: Expected detail of visual imagery (Provided by: ProtectedSeas)

Coverage from MPA to port: Discuss the potential for an officer to track a vessel of interest after it leaves an MPA until it can be intercepted. In some cases, it may be possible to track the vessel from MPA to port.

Research and monitoring data: In some cases, scientific efforts to research and monitor human activity may benefit from the addition of M2 data reports.

Assessor's notes about expected value:

Perceived Strengths – Which potential end users have high expectations and why:

Perceived limitations – Which potential end users are skeptical about M2 and why:

Other notes about end user perspective:

CRITERION 4: SITE HOST AND PERMITTING PATH

Is there a committed host and acceptable permitting path and timeline for siting an M2 unit?

Purpose: Use to minimize the risk that a landowner may choose not to host M2 or that a permitting process may not result in permission to establish the site.

Factors for	Yes	Worklist Item	No
Committed host: Is there a committed host?			
Permitting path: Can the permitting process be accomplished within an acceptable timeline, at a reasonable cost?			

DISCUSSION POINTS FOR SITE HOST AND PERMITTING PATH

Committed host: There are distinct types of land-owning hosts including government agencies, non-governmental organizations, and private individuals. Normally, it is worth cultivating relationships with each potential host that can offer an appropriate location. Explore the level of commitment for each host and back-up host. Is the host fully committed to provide a long-term, multi-year home for the M2 system? Could an M3 (mobile version of M2) be moved from one host's site to another host's site?

- A fully committed host has signed or is ready to sign a contract for multiple years.
- A potential host is seriously considering a long-term commitment.
- A prospective host is aware and is actively engaged, wanting to learn more.

In each case, the level of commitment should be gauged after the host has had an opportunity to observe similar M2 sites and fully understands the visual, audible, and social implications of hosting an M2 system. For example, a point of land may offer an ideal location for M2 but may also be a cherished memorial space which would make deployment of M2 unpopular at that site.

Permitting path: What local, state, and federal permits are required, and can each process be accomplished within an acceptable timeline, at reasonable cost?

Various federal, state, and local permits may be required prior to installation of an M2 system. In the case of Anacapa Island, for example, permitting took years to place a system on federal national park land, because of the historical and cultural nature of the site.

Assessor's notes for site host commitment and required permitting:

Potential site 1:

Potential site 2:

Other notes:

CRITERION 5: SITE PARTNER READINESS

Are M2 site partners and funders ready to provide long term support?

Purpose: Use to assess readiness in terms of funding, workforce readiness, and the potential for collaborative leadership between site partners and enforcement officers.

Factors for	Yes	Worklist item	No
Funding for installation: Have potential site partners identified sources of funding for initial installation?			
Long-term funding: Have funding partners made a multi-year commitment?			
Site partner readiness: Have partner organizations committed to provide first line operational support for M2 users and data analysis for investigations, case files, and reports?			
Relationships with enforcement officers: Do site partners have an established working relationship with CDFW wildlife officers and other enforcement partners?			

DISCUSSION POINTS FOR SITE PARTNER READINESS

Before moving forward with an M2 deployment, it is critical that a robust local partnership is ready to lead the project to ensure a maximum return on investment.

Note: The MPA Collaborative Network is a valuable resource when considering how to strengthen local partnerships by facilitating development of a shared vision for use of M2. ProtectedSeas leaders also bring a wealth of experience and can help build partnerships.

Funding for installation: Is funding available for initial installation? The need could vary between \$100,000 and \$175,000 (in 2026 dollars), depending on the configuration, installation challenges, and permitting data requirements.

Long-term funding for maintenance, repair, upgrades: Have funding partners made a multi-year commitment to provide resources needed to maintain, repair, and upgrade the system to achieve an agreed upon level of system reliability? Required funds may include compensation for partner organizations that provide skilled labor for scheduled maintenance, upgrades, and unexpected repairs. Each situation is different, but ProtectedSeas along with site partners in other locations can help prepare an estimate of annual cost.

Site Partner Readiness - Operational Support and Data Analysis: Have partner organizations committed to provide first line operational support for M2 users and data analysis for

investigations, case files, and reports? This will require dedicated work time and funding for M2 workforce needs. How engaged are the members of supporting site partner organizations?

Note: First line operational support includes assisting users with best use of M2 Viewer and real-time alerts. It also requires periodic check-ins with all users supported by the site partner.

Relationships with Enforcement Officers: Do site partners have an established working relationship with CDFW wildlife officers and other enforcement partners? Will site partners help officers develop competency by providing training, facilitating frequent practice, and maintaining a strong working relationship? For those officers who already have an M2 in their area, how frequently do they log into the M2 Viewer? Did they sign up to receive alerts?

Assessor's notes for site partner readiness:

Funding:
Site partner readiness:
Relationships with enforcement officers:

READINESS ASSESSMENT – STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND THREATS (SWOT) ANALYSIS

In the spaces below, summarize findings from use of this guide. There are quadrants in the table for site specific strengths, weaknesses, opportunities to make best use of limited resources, and threats to the project, often from external forces.

Strengths (how M2 will add value in proposed location):	Weaknesses (limitations of M2 in proposed location; distinguish between permanent and improvable factors):
Opportunities (favorable factors related to investment in M2 for proposed location):	Threats (risk factors related to investment in M2 for proposed location):

DECISION DASHBOARD FOR THE FIVE CRITERIA

After working through this guide, taking notes for each criterion, and completing the SWOT readiness assessment, make decisions. Use your qualitative results to decide whether each criterion has been met (Yes), can be achieved with additional preparation (Not yet), or cannot be met (No). Typically, need and site suitability criteria are knockout, “go” or “no-go”, while the other criteria can be improved upon through the work of a resolute project team.

Name of MPA (Describe Prohibitions):			
Criteria	Yes	Not yet	No
Vessel borne compliance need			
Suitable placement (ex: geometry, distance)			
High value expected by end users			
Site host and permitting path			
Site partner readiness			
Additional considerations: Describe decision factors that may lead to a “yes” or a “no” despite the outcomes listed above.			

Name of MPA (Describe Prohibitions):			
Criteria	Yes	Not Yet	No
Vessel borne compliance need			
Suitable placement (ex: geometry, distance)			
High value expected by end users			
Site host and permitting path			
Site partner readiness			
Additional considerations: Describe decision factors that may lead to a “yes” or a “no” despite the outcomes listed above.			

DECISION DASHBOARD EXAMPLES

The example below represents an assessment of three separate locations in south Orange County. Locations include Dana Point, Laguna Beach, and Crystal Cove MPAs.

Dana Point SMCA (Prohibitions are mostly inter-tidal)			
Criteria	Yes	Not Yet	No
Vessel borne compliance need			
Suitable placement (ex: geometry, distance)			
High value expected by end users			
Site host and permitting path			
Site partner readiness			
Additional considerations: Need & site geometry - although M2 will not add much value for the Dana Point SMCA, it would cover part of the Laguna Beach no-take SMCA and SMR and would enable tracking of vessels of interest between those MPAs and Dana Point harbor. In addition, this site is excellent for monitoring vessel interactions with whales, supporting the mission of wildlife officers beyond MPA boundaries.			

Laguna SMR and No-Take SMCA (No-Take extending out to almost 3 miles)			
Criteria	Yes	Not Yet	No
Vessel borne compliance need			
Suitable placement (ex: geometry, distance)			
High value expected by end users			
Site host and permitting path			
Site partner readiness			
Additional considerations: Regarding site host, Laguna Beach must prioritize the aesthetics of coastal spaces, which makes placement of M2 difficult. However, initial discussions among MPA Collaborative suggest that with structural modifications it may be possible to site radar and camera at Heisler Park gazebo and other hardware at the lifeguard station. Funding will be needed to make structural alterations, including cliff stabilization for the gazebo. Need - This area also offers opportunity to monitor vessel interactions with whales.			

Crystal Cove SMCA (Prohibitions are mostly inter-tidal)			
Criteria	Yes	Not Yet	No
Vessel borne compliance need			
Suitable placement (ex: geometry, distance)			
High value expected by end users			
Site host and permitting path			
Site partner readiness			
Additional considerations: Need – covers part of Laguna MPAs & could track vessels of interest to Newport; could monitor some inter-tidal activity, vessel-whale interactions. Permitting in State Park takes years.			

CONCLUSION

The purpose of this guide is to inform decision making through structured conversations among partners who are considering supporting MPA compliance and enforcement with M2. The hope is that these conversations will include and go far beyond the ideas included in this guide. Use the guide to collect qualitative information through many discussions and then generate a project plan based on the results.

Thank you for exploring the potential of M2 to support MPA compliance. Even if the best choice is not to invest in M2 for the proposed location, the conversations you engage in will exercise an important aspect of marine conservation – cultivating a shared vision and common goals among MPA partners.

Produced by:

Greg Wisener
Captain, U. S. Coast Guard (retired)
Graduate Researcher
Master of Advanced Studies in Marine Biodiversity and Conservation
UCSD, Scripps Institution of Oceanography
June 2026
gwisener52@gmail.com

Supported by Capstone Advisory Committee:

Samantha Murray, JD (Chair)
CA Fish and Game Commission, Scripps Institution of Oceanography

Anastasia Cervantes
California Marine Sanctuary Foundation

Katie O'Donnell
WILDCOAST

Samantha "Sam" King
ProtectedSeas

ONLINE RESOURCES

USEFUL INFORMATION:

California Department of Fish and Wildlife. *About California's marine protected areas: Designations.* <https://wildlife.ca.gov/Conservation/Marine/MPAs/About#designations>

California Department of Fish and Wildlife. *California marine protected areas: Interactive web map.* <https://experience.arcgis.com/experience/ff600a0249fe42f6aba0a0c30cc52eed>

California Department of Fish and Wildlife. *Law Enforcement Division.* <https://wildlife.ca.gov/Organization/LED>

MPA Collaborative Network. *Home.* <https://www.mpacollaborative.org/>

SITE PARTNERS:

California Marine Sanctuary Foundation. *Marine conservation.* <https://www.californiamsf.org/marine-conservation>

ProtectedSeas. *M2 Marine Monitor.* <https://m2marinemonitor.com/>

WILDCOAST. <https://wildcoast.org/about-us/>

FUNDING SUPPORT AND ADVICE:

California Ocean Protection Council. *Biodiversity.* <https://opc.ca.gov/biodiversity/>

Resources Legacy Fund. *Partner with us.* <https://resourceslegacyfund.org/partner-with-us/>

MARINE MONITOR (M2) PRO-TIPS FOR MPA ENFORCEMENT

M2 Capabilities

The Marine Monitor (M2) system provides continuous Automatic Identification System (AIS), RADAR, and camera coverage of select MPAs. It has the ability to correlate these sensors and other data sources. Correlating a track allows an enforcement officer to include multiple sensors among the totality of circumstances observed when making contact with a vessel and the people on board. M2 provides position information along with direction and speed of each tracked vessel. Depending on distance and visibility, the camera can help with vessel identification, clarifying the type of vessel and gear on board, identifying the method of take, and observing activity of the people on board.

Your M2 Supporting Cast

While the goal is to enable you to operate smoothly and independently when it comes to M2, please know that you are not alone. Your primary “go to” for support are the people at ProtectedSeas. They will get you an M2 Viewer account and help you get started. ProtectedSeas wants your feedback, and they strive to continually improve the system so it is more useful to you. Let them know if M2 is or is not meeting your needs. Local M2 Site Partners, working with ProtectedSeas, provide periodic training and monthly reports that can be tailored upon request. If you want to talk to other officers about how they use M2, your Site Partner may be able to connect you. Site Partners include WILDCOAST in San Diego County, California Marine Sanctuary Foundation (CMSF) in the Santa Barbara Channel, and other marine conservation organizations.

Set yourself up for success

- (1) Get an account: Request an M2 Viewer account from ProtectedSeas by emailing m2@protectedseas.net. Give them your name and contact information, describe what your role is, and which M2 sites you would like access to. Copy your local site partner so they know you're now part of the local team that uses M2 information.
- (2) Connect with supporting cast: Sign up for training with your site partner and ProtectedSeas. Navigate through the system, before training, so you can get the most out of it. Sign up with your local site partner for monthly data reports.
- (3) Alerts: Setup and adjust real time alerts received via SMS text messaging or email. You can set alerts for specific parameters including vessel speed and loitering time. You can also create specific geographic zones or “geofences” that will trigger alerts tailored to your area of operations and the likely behavior of suspect vessels. M2 can be setup to send alerts only during your normal work hours. There is a user manual within the desktop M2 Viewer. Reach out to ProtectedSeas if you get stuck.

- (4) M2 Viewer, Mobile and Desktop: The data available and buttonology varies between the desktop and mobile versions of the M2 Viewer. Spend time with each, observing activity and using the functionality to observe vessel tracks and the imagery linked to them. The mobile viewer does not have playback capability while the desktop version does.
- (5) Connectivity: The M2 Mobile Viewer is intended to work with a modest cell phone connection. It is a good idea to observe the Viewer in areas around the covered MPA to see the quality of connectivity for your area.

Patrol planning

- (1) Deciding when to patrol the area (daily planning): Reviewing real time information, daily, or weekly reports can help with the decision of when to patrol a covered area. Using M2 for patrol planning can increase the likelihood of encountering a vessel engaged in illicit activity. It can also save time and fuel when there isn't much happening near the covered MPA.
- (2) Longer term planning (weekly or monthly planning cycle): Check out the "Download Report" function on the M2 Viewer. See if you can glean some insights from the years of stored data. For example, you may choose to look at a specific week, month, or quarter over a number of years to see seasonal patterns.
- (3) Observing patterns of behavior: The monthly reports provided by your Site Partner are a useful resource for finding and analyzing patterns of behavior. Let them know if you would like tailored reports. The reports are for you, so Site Partners want to know what works well and what could be better.

Pre-contact observation

- (1) Vessel position relative to MPA boundaries: RADAR is very accurate at determining the position of a vessel. You can be confident in the position data, relative to the MPA boundary, available in the M2 Viewer.
- (2) Direction and speed of movement (vessel tracking): M2 is highly accurate regarding the direction and speed of vessel movement. For example, it will make clear whether a vessel is drifting into or out of an MPA. Camera imagery: The camera imagery may be clear enough to show the type of vessel, number of people on deck, gear type, and method of take. Reach out to ProtectedSeas if you need the camera to provide information in a different way. In specific cases, they can take control of the camera to focus on a specific vessel or provide more frequent images.
- (3) Camera video: Video may show people engaged in illegal take. M2 cameras capture video, but due to the cost of data transmission they often don't send it to

the M2 Viewer. You can view the live stream and save the relevant sections. Contact ProtectedSeas if the viewer isn't providing what you need.

- (4) Vessel identification: If the vessel isn't too far away and the visibility is good, the camera imagery can help officers to correlate radar tracks with specific vessels. This can be achieved by observing hull shape and color, unique gear, the 4 inch tall hull name, 10 inch tall Fish and Game number for commercial fishing vessels, or the 3 inch tall CF number. Imagery may also help to show how many people are on board. All of this may be useful when you can intercept and make contact.

M2 data support when making contact within an MPA

- (1) Camera lock on a specific vessel: Target lock is available through the M2 Mobile Viewer.
- (2) Verifying your patrol vessel as an M2 track: Your patrol vessel's navigation and RADAR systems can, if calibrated, help correlate M2 track data with your patrol vessel and what your sensors observe as you approach. If the position of the patrol vessel is known then it becomes possible to correlate other M2 tracks to suspect vessels based on the observed bearing and range from the patrol vessel. This is a way to extend the sensor capability of your patrol vessel to include M2 sensor data and to link M2 tracks to patrol vessel tracks.
- (3) A record of vessel behavior: M2 data can provide a history of how the vessel and people on board behaved before and after observing your patrol vessel. It can also record how they behaved during your intercept, during officer contact, and after the officer departs the M2 coverage area.

Tracking vessels after they leave MPAs

- (1) Intercepting a vessel using M2 Viewer: When it is not possible to intercept a vessel inside of the MPA, an officer can continue to track it until intercept is possible. M2 can help estimate where the best place for intercept will be based on the vessel's course and speed.
- (2) Comparing camera images to intercepted vessel: Camera imagery can help link vessels observed by M2 to vessels intercepted by officers, even if the vessel has left the M2 RADAR coverage area.
- (3) Data available after vessel leaves MPA: If a vessel of interest has left the M2 coverage area, you can use the playback function of the M2 Viewer to correlate what the camera saw with what you observe once you're able to make contact.

Investigations, Case Files, Support for Prosecution

- (1) Focused reports: If a vessel is transmitting AIS, you may be able to observe that vessel's historical patterns using the M2 Viewer.

- (2) Reports that show patterns: Use the reporting function to identify patterns of behavior.
- (3) Calibration data: ProtectedSeas is prepared to speak to the calibration and reliability of M2 data in court.

Relationship with ProtectedSeas and supporting Site Partners

- (1) Reach out early and often: Your support team can help!
- (2) Tailored information: Don't hesitate to ask, make your needs known.
- (3) Area familiarization: Offer your Site Partner ride-alongs to observe MPAs with you, from your perspective.
- (4) Real time support: Have a chat with your Site Partner to work out what is possible, and how best to ask for support for tasks you can't do in the field.
- (5) Monthly reports and other data support: Give your Site Partner feedback with each monthly report until the reports are something you look forward to and use.
- (6) Case specific support: Let your Site Partner and ProtectedSeas know what you need, early on.

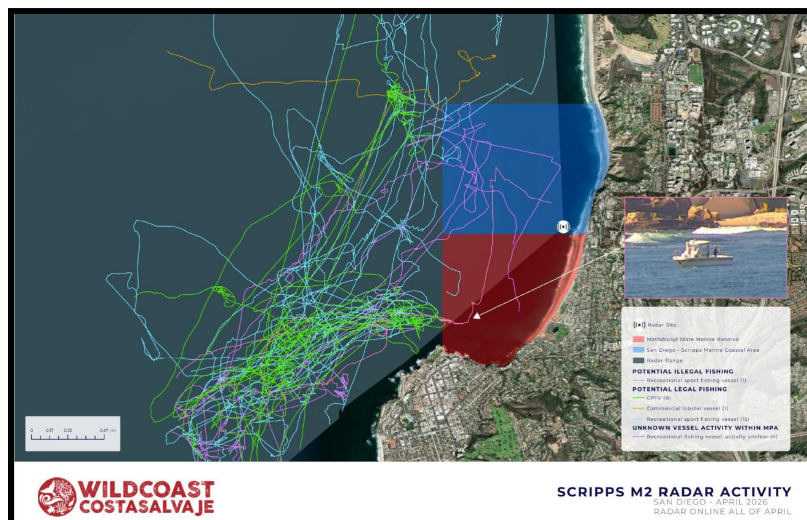


Figure 1: Excerpt from monthly report for Scripps Pier M2 Site

Share your perspective on where M2 should be deployed next

- (1) Discuss known hotspots: Do you know of hotspots that should have M2 coverage? You can lead the conversation about future M2 deployments.
- (2) Discuss remote areas where risk of illegal take may be unknown: Do you have MPAs that are remote and/or hard to visit? Discuss the potential for M2 to help.

M2 SITE PARTNER GUIDE: STRUCTURED FEEDBACK FROM OFFICERS

Purpose: This guide is best used by Site Partners or ProtectedSeas when checking-in with wildlife officers and allied officers who are responsible for MPAs supported by a M2 system or systems. It is meant for periodic conversations with those officers who have an M2 Viewer account. A semi-structured chat can usually be completed within 15 to 30 minutes.

Frequency: Ideally, Site Partners will personally connect with each warden, officer, or team leader at least twice a year, perhaps at the start of the busy season and mid-way through or near the end of the high activity season for supported MPAs. Check-in frequency can be increased as desired.

Feedback Categories: A successful interview may cover many of the following topics while learning about current state and desired future state of M2 support:

- I. M2 Viewer access and ease of use
- II. Patrol Planning
- III. Alerts
- IV. Observation prior to making contact
- V. RADAR and camera support while making contact
- VI. Case file preparation
- VII. Investigations or focused effort
- VIII. Tracking vessels after they leave MPAs (until M2 loses contact)
- IX. Site partner communication and support
- X. General feedback and ideas for the future

Guiding Questions:

- I. M2 Viewer access and ease of use
 - A. Do you use the Desktop Viewer? When? Why or why not?
 - B. Do you use the Mobile Viewer? When? Where? Why or why not?
 - C. Where or when do you lack reliable connectivity? Why?
 - D. How could we make M2 more easily accessible for you?
- II. Patrol Planning
 - A. How do you use M2 to support planning for daily, weekly, or monthly planning cycles?
 - B. What information would you like to see from M2 to better support your planning in the future?

- III. Alerts
 - A. What alert setup currently works best for you?
 - B. Would you benefit from any updates to the zone alarm boundaries or definitions? Or request any new zones?
 - C. What alert options would you like to have in the future?
- IV. Observation prior to making contact
 - A. How do you currently use M2 prior to making contact? Position? Method? Activity?
 - B. How could M2 better support you prior to contact?
- V. RADAR and camera support while making contact
 - A. How does M2 currently support you while you're making contact and questioning?
 - B. In the future, how could M2 better support you while making contact?
- VI. Case File Preparation
 - A. What M2 tools and products do you currently use when documenting an MPA violation?
 - B. In the future, how could M2 better support case file documentation?
 - C. In the future, how could M2 better support prosecuting attorneys?
- VII. Investigations or focused effort
 - A. What M2 tools and products are most useful when conducting an investigation or focusing effort towards a pattern of potential violations?
 - B. In the future, how could M2 better support investigations or focused effort?
- VIII. Tracking vessels after they leave MPAs
 - A. Does M2 provide sufficient line of sight coverage for continuous tracking until you can intercept and make contact with a vessel that was flagged within an MPA? Is that helpful?
 - B. Could the system provide better support for tracking vessels? How?
- IX. Site Partner communication and support
 - A. What is currently useful about our monthly reports? Why?
 - B. What would you like to see in our monthly reports?
 - C. How are we doing when it comes to communicating about system reliability?
 - D. How can we help make M2 more useful for you?
- X. General feedback and ideas for the future
 - A. What's currently working well regarding M2 support?
 - B. What isn't currently working well?
 - C. If there were few resource constraints, how could M2 provide the best support for your enforcement mission in the future? What would be top priority, once we do constrain our imaginations? :)

- D. Does the mere presence of an M2 system serve as a deterrent that improves compliance? Why or why not?
- E. Other thoughts?