

Appendix III: MPA ‘protection regime’ categories

Several characteristics of the MPA that may potentially influence the magnitude of response to protection include (i) the type of the restricted and permitted activities within the partially protected area and (ii) the scale of the permitted activities, whether commercial or recreational, within the partially protected area. Collectively, we refer to these characteristics as ‘protection regime’ of the partially protected area.

Approach

Information about the ‘protection regime’ for each MPA was extracted from the studies. When this was lacking or unclear the first authors were contacted, and in the event of no reply additional publications and web resources were consulted. A detailed description of the ‘protection regime’ for each MPA is given in Table 2 and Table 3. We then applied the questions in Table 1, once using the data on the type of restricted activities and once using the data on the type and scale of the permitted activities inside the partially protected area, to categorize the partially protected areas by their ‘protection regime’. When more than one fishing activity was restricted and/or permitted within the MPA, the answer to the questions was based on the activity with the potentially most negative impact on biota and their surrounding environment. The two binary datasets were examined in PRIMER v. 6 using CLUSTER analysis to identify categories based on ‘protection regime’. CLUSTER analysis was used to minimize bias through subjective judgment.

Table 1. Questions applied to categorize the partially protected areas by their ‘protection regime’

Question re fishing activity		Answer	
Q1.	Is it destructive or damaging to bottom habitats?	Yes (1)	No (0)
Q2.	Does it target particular species or group of species?	Yes (1)	No (0)
Q3.	Is it a selective fishing practice in terms of size of individuals?	Yes (1)	No (0)
Q4.	Is it likely to impact non-target species through by-catch?	Yes (1)	No (0)
Q5.	Is the activity carried out for subsistence or leisure/recreation purposes?	Subsistence (1)	Recreation (0)
Q6.	Is subsistence fishing carried out on a commercial scale or on a local/domestic scale?	Commercial (1)	Domestic (0)

Outcome

The CLUSTER analysis divided the partially protected areas into two main groups based on the **activities restricted** within their boundaries:

- (a) those that restrict activities that damage bottom habitats and have high incidence of impacting non-target species, referred to hereafter as **‘Indiscriminate’**
- (b) those that restrict activities that only effect particular target species but not the surrounding environment, referred to hereafter as **‘Discriminate’**

Based on the activities **permitted** inside the partially protected area, the CLUSTER analysis divided the partially protected areas into four groups:

- (a) those that allow recreational fishing using size-selective methods, referred to hereafter as **‘recreational, selective’**
- (b) those that allow subsistence fishing on a personal-use (domestic) scale using size-selective methods, referred to hereafter as **‘domestic, selective’**
- (c) those that allow subsistence fishing on a commercial scale using size-selective methods, referred to hereafter as **‘commercial, selective’**
- (d) those that allow subsistence fishing on a commercial scale using methods that are non-selective in terms of size of individuals, referred to hereafter as **‘commercial, non-selective’**

The partially protected areas in our dataset fell within six of the ‘protection regime’ categories identified by CLUSTER analysis. However, since there were not enough partially protected areas for statistical analysis of all the six ‘protection regime’ categories some categories were grouped together as follows:

‘Indiscriminate; commercial, selective’	}	‘Indiscriminate; commercial’ = IdC
‘Indiscriminate; commercial, non-selective’		
‘Discriminate; commercial, selective’	}	‘Discriminate; commercial’ = DC
‘Discriminate; commercial, non-selective’		
‘Discriminate; recreational, selective’	}	‘Discriminate; recreational’ = DR
‘Discriminate; domestic, selective’		

Table 2. Description of the fishing activities that are restricted within the partially protected areas included in our dataset. The response to the questions in Table 1 is given under the headings Q1 to Q6 for each MPA. In the event of more than one fishing activity being restricted inside the MPA, we based answers to Q1 to Q6 on the activity marked in bold. The resulting category identified by CLUSTER analysis is given under ‘Category’.

PPA name	Restricted activities	Q1	Q2	Q3	Q4	Q5	Q6	Category
[1] Arraial de Cabo	na	No indication of the type fishing gear restricted						
[2] [3] Scandola PPA	Amateur fishing, spearfishing , SCUBA diving	0	1	1	0	0	na	Discriminate
[4] Ahus Island TA	Spear and net fishing	0	1	1	0	1	1	Discriminate
[5] Manele-Hulopoe MLCD	Spearfishing , trap and net fishing in 50% MLCD	0	1	1	0	1	0	Discriminate
[5] Old-Kona Airport MLCD	na	No indication of the type fishing gear restricted						
[5] Lapakahi MLCD	na	No indication of the type fishing gear restricted						
[5] Waialea Bay MLCD	na	No indication of the type fishing gear restricted						
[5] Molokini Shoal MLCD	na	No indication of the type fishing gear restricted						
[6] [18] Virgin Island CRNM	extractive uses, anchoring	0	1	0	0	1	1	Discriminate
[7] Pupukea MLCD	na	No indication of the type fishing gear restricted						
[7] Kealakekua Bay MLCD	na	No indication of the type fishing gear restricted						
[8] Sugar Loaf Island FCA	Commercial fishing, recreational set netting , longlining	0	1	0	0	1	1	Discriminate
[8] Sugar Loaf Island PPA	Commercial & recreational fishing, anchoring by commercial vessels, mining & drilling	0	1	0	0	1	1	Discriminate
[9] [26] [51] Mimiwhangata MP	Commercial fishing, nets & long-lines	0	1	0	0	1	1	Discriminate
[10] Tabarca Island BZ	Recreational fishing, anchoring. Professional fishing (with traditional gears) is regulated	0	1	0	0	1	1	Discriminate
[11] Virgin Island NP	Spearfishing, commercial fishing using cast nets with mesh > 2.5cm or over 6.1m in length	0	1	0	0	1	1	Discriminate

[12] Italcomis Reef MUZ	Fishing for aquarium species, drive nets	0	1	0	0	1	1	Discriminate
[13] TMPA – PPA1	Spearfishing	0	1	1	0	0	na	Discriminate
[13] TMPA – PPA2	Spearfishing	0	1	1	0	0	na	Discriminate
[14] 25nm FMZ	Trawling within 3nm from coast, and in specified areas beyond 3nm	1	1	1	1	1	1	Indiscriminate
[15] Northeast of Horn	Closed to trawling since 1992 and fishing with longline in 1993	1	1	1	1	1	1	Indiscriminate
[15] Langesgrunn	Closed to trawling since 1992 and fishing with longline in 1994	1	1	1	1	1	1	Indiscriminate
[15] Off Northeast coast	Closed to trawling since 1970s and to longline since 1993	1	1	1	1	1	1	Indiscriminate
[16] Barbados MR	Spearfishing , hook-and-line fishing, cast netting , trapping	0	1	1	1	1	1	Discriminate
[17] La Jolla ER	na	No indication of the type fishing gear restricted						
[19] [23] Achang reef MP	Extraction of adult fish, or the use of any fishing gear up to a depth of over 600ft	No indication of the type fishing gear restricted						
[19] Tumon Bay MP	na	No indication of the type fishing gear restricted						
[20] Easter Group MPA	Hook-and-line, any form of netting, trawling for scallops/prawns , trolling with rods and lures for species such as coral trout, spearfishing	1	1	1	1	1	1	Indiscriminate
[20] Wallabi Group MPA	Hook-and-line, any form of netting, trawling for scallops/prawns , trolling with rods and lures for species such as coral trout, spearfishing	1	1	1	1	1	1	Indiscriminate
[21] Western Gulf of Maine CA	Mobile bottom gear , gill netting	1	1	0	1	1	1	Indiscriminate
[22] North Kohala FRA	Fishing for aquarium species	No indication of the type fishing gear restricted						
[22] Puako-'Anaeho 'Omalu FRA	Fishing for aquarium species	No indication of the type fishing gear restricted						
[22] Ka'upulehu FRA	Fishing for aquarium species	No indication of the type fishing gear restricted						

[22] Kaloka-Honokohau FRA	Fishing for aquarium species	No indication of the type fishing gear restricted						
[22] Kailua-Kona (S. Oneo Bay) FRA	Fishing for aquarium species	No indication of the type fishing gear restricted						
[22] Kailua-Kona (N. Keauhou) FRA	Fishing for aquarium species	No indication of the type fishing gear restricted						
[22] Napo' opo' o-Honaunau FRA	Fishing for aquarium species	No indication of the type fishing gear restricted						
[22] Ho'okena FRA	Fishing for aquarium species	No indication of the type fishing gear restricted						
[22] Milioli'I FRA	Fishing for aquarium species	No indication of the type fishing gear restricted						
[23] Piti MP	Extraction of adult fish, or the use of any fishing gear up to a depth of over 600ft	No indication of the type fishing gear restricted						
[24] [32] [44] Cerbere-Banyuls MNR	Spearfishing	0	1	1	0	0	na	Discriminate
[25] Houtman-Abrolhos ROAs	Fishing for scalefish species	1	1	1	1	1	1	Indiscriminate
[27] Isla La Graciosa BZ	Traps , underwater fishing	0	1	1	0	1	1	Discriminate
[27] [49] Punta La Restiga BZ	Traps , underwater fishing	0	1	1	0	1	1	Discriminate
[29] Admiral Cockburn NPMR	Commercial fishing	No indication of the type fishing gear restricted						
[30] Mtang'ata CFMZ	Dynamite & poison fishing , beach seining, dragging of nets	1	1	1	1	1	1	Indiscriminate
[28] [31] Gulf of Castellammare FR	Fishing with trawl nets, bottom towed gear	1	1	1	1	1	1	Indiscriminate
[33] Jurien Bay MP	Finfish fishing using lines & nets	0	1	0	0	1	1	Discriminate
[34] CA-I	Trawls , gill nets, scallop dredge (no bottom tending gear allowed)	1	1	1	1	1	1	Indiscriminate
[34] [40] CA-II	Trawls , gill nets, scallop dredge (no bottom tending gear allowed)	1	1	1	1	1	1	Indiscriminate
[35] [36] Western Gulf of Maine CA	Mobile bottom tending gear & gill netting	1	1	1	1	1	1	Indiscriminate
[37] Patagonian scallop management unit "Reclutas"	Commercial scallop fishing	1	1	1	1	1	1	Indiscriminate

[38] South Evvoikos Gulf	Bottom trawling	1	1	1	1	1	1	Indiscriminate
[39] Two-headed Gully	Bottom-trawling, scallop dredging	1	1	1	1	1	1	Indiscriminate
[41] Port Erin exclusion zone	Bottom fishing	1	1	1	1	1	1	Indiscriminate
[42] Inshore Potting Agreement	Fishing with mobile gear (trawls + dredges)	1	1	1	1	1	1	Indiscriminate
[43] Commercial exclusion zones	Commercial fishing for lobster	0	1	1	0	1	1	Discriminate
[45] Arnavon Island MCA	Commercial fishing, spearfishing	0	1	1	0	0	na	Discriminate
[46] Glacier Bay National Park	Commercial fishing	No indication of the type fishing gear restricted						
[47] Bell Island + Lime Kiln	Collection of finfish	No indication of the type fishing gear restricted						
[48] Medes Island partial reserve	Collection of intertidal animals, spear fishing	0	1	1	0	0	na	Discriminate
[49] Isla de la Palma RFA	Recreational fishing from boat, spear fishing , angling from the shore	0	1	1	0	0	na	Discriminate
[49] Isla Graciosa RFA	Spearfishing	0	1	1	0	0	na	Discriminate
[49] Punta de La restinga RFA	na	No indication of the type fishing gear restricted						
[50] Santa Catalina Inv NTRA	Commercial & recreational fishing for lobster	0	1	1	0	1	1	Discriminate
[52] [58] Giannutri Island LPA	Commercial fishing, spearfishing	0	1	1	0	0	na	Discriminate
[53] [60] Ustica Island GR	Trawling , spearfishing, sea urchin harvesting	1	1	1	1	1	1	Indiscriminate
[53] [60] Ustica Island PR	Trawling , purse seining	1	1	1	1	1	1	Indiscriminate
[54] Mayor Island RFA	Commercial fishing, recreational fishing with set nets (including gill nets) and long lines	0	1	0	0	1	1	Discriminate
[55] [62] Rottnest Island reserve	Commercial lobster fishing within 1600m from shore, recreational sport fishing within 800m from shore, spearfishing	0	1	1	0	1	1	Discriminate
[56] recreational zone	Commercial fishing (beach netting & spearing not allowed except in some areas)	0	1	1	0	1	1	Discriminate

[57] Mpunguti MNR	Spearfishing, poison fishing , aquarium fishing	1	1	1	1	1	0	Indiscriminate
[58] Capraia Is zone 2	Spearfishing	0	1	1	0	0	na	Discriminate
[59] Charlotte Sound	Commercial fishing for blue cod	No indication of the type fishing gear restricted						
[61] Glover's Reef MRGUZ	Trap fishing , SCUBA diving, spearfishing	0	1	1	0	1	1	Discriminate

Table 3. Description of the fishing activities permitted within the partially protected areas included in our dataset. The response to the questions in Table 1 is given under the headings Q1 to Q6 for each MPA. In the event of more than one fishing activity being restricted inside the MPA, we based answers to Q1 to Q6 on the activity marked in bold. The resulting category identified by CLUSTER analysis is given under ‘Category’.

PPA name	Permitted activities	Q1	Q2	Q3	Q4	Q5	Q6	Category
[1] Arraial de Cabo	Fishing using traditional techniques	0	1	0	0	1	1	Commercial
[2] [3] Scandola PPA	Professional fishing using small boats with low engine power & traditional fishing methods	0	1	0	0	1	1	Commercial
[4] Ahus Island TA	Line fishing, limited harvesting of invertebrates allowed 3 times a year	0	1	0	0	1	0	Domestic
[5] Manele-Hulopoe MLCD	Hook & line (shore), thrownet allowed in all of the MLCD	0	1	0	0	1	1	Commercial
[5] Old-Kona Airport MLCD	Thrownet & pole-and-line (shore), sea urchin collecting from June to October	0	1	0	0	1	1	Commercial
[5] Lapakahi MLCD	Hook & line, thrownet , liftnet for opelu in 90% of MLCD	0	1	0	0	1	1	Commercial
[5] Waialea Bay MLCD	Netting	0	1	0	0	1	1	Commercial
[5] Molokini Shoal MLCD	Trolling in 60% of MLCD	0	1	1	0	1	1	Commercial
[6] [18] Virgin Island CRNM	Fishing for blue runner (<i>Caranx crysos</i>) by hand line and of baitfish using a castnet	0	1	1	0	1	1	Commercial

[7] Pupukea MLCD	pole-and-line (shore) and harvest of seaweed	0	1	1	0	1	1	Commercial
[7] Kealakekua Bay MLCD	hook-and-line, throw net , harvest of seaweed & crustaceans in 60% of MLCD	0	1	0	0	1	1	Commercial
[8] Sugar Loaf Island FCA	Fishing for kahawai (Arripis trutta) and kingfish (Seriola lalandi) for bait, either through trolling or spearfishing . Recreational fishing, diving and potting for rock lobster	0	1	1	0	0	na	Domestic/recreational
[8] Sugar Loaf Island PPA	Trolling & spearfishing for kingfish (Seriola lalandi) and kahawi (Arripis trutta)	0	1	1	0	1	0	Domestic/recreational
[9] [26] [51] Mimiwhangata MP	Recreational fishing with unweighted, single-hook lines, trolling, spearfishing	0	1	1	0	0	na	Recreational
[10] Tabarca Island BZ	Troll lines, 10 trap nets to catch Atherinidae fish from Oct-Dec, sport fishing by rod, controlled diving	0	1	0	0	1	1	Commercial
[11] Virgin Island NP	Fishing including with traps	0	1	1	0	1	1	Commercial
[12] Italcomis Reef MUZ	Hand lines, spears & various types of nets are allowed by local community only	0	1	0	0	1	0	Domestic
[13] TMPA – PPA1	Professional & regulated recreational fishing	0	1	1	0	0	na	Recreational
[13] TMPA – PPA2	Fishing with trammel/gillnets , longlines by local fishermen	0	1	0	0	1	1	Commercial
[14] 25nm FMZ	artisanal fishing, restricted trawling in specified areas, lampuki fishing using Fish Aggregating Device, Lampara using a small scale pelagic purse seine that targets bodue & mackerel, fishing for tuna, swordfish & highly migratory fish	1	1	0	1	1	1	Commercial
[15] Northeast of Horn	na but assuming that use of fishing gear that does not make contact with the seafloor is allowed	0	1	1	0	1	1	Commercial
[15] Langesgrunn	na but assuming that use of fishing gear that does not make contact with the seafloor is allowed	0	1	1	0	1	1	Commercial

[15] Off Northeast coast	na but assuming that use of fishing gear that does not make contact with the seafloor is allowed	0	1	1	0	1	1	Commercial
[16] Barbados MR	Fishing with cast netting for clupeids	0	1	0	0	1	0	Domestic
[17] La Jolla ER	Commercial bait fishing for squid by hand-held scoop net	0	1	1	0	1	1	Commercial
[19] [23] Achang reef MP	Seasonal fishing for Siganus & Mulloidichthys using cast nets and hook-and-line	0	1	0	0	1	0	Domestic
[19] Tumon Bay MP	Traditional fishing with hook-and-line or cast net from the shore is allowed for 4 types of fish: Acanthurus triostegus, Siganus spp. Caranx spp, Mullidae	0	1	1	0	1	0	Domestic
[20] Easter Group MPA	Potting for rock lobster	0	1	1	0	1	1	Commercial
[20] Wallabi Group MPA	Potting for rock lobster	0	1	1	0	1	1	Commercial
[21] Western Gulf of Maine CA	Shrimp trawls , lobster traps, mid-water trawls, research bottom trawling, recreational fishing	1	1	0	1	1	1	Commercial
[22] North Kohala FRA	na	No indication of the type fishing activities permitted						
[22] Puako-'Anaeho 'Omalu FRA	na	No indication of the type fishing activities permitted						
[22] Ka'upulehu FRA	na	No indication of the type fishing activities permitted						
[22] Kaloka-Honokohau FRA	na	No indication of the type fishing activities permitted						
[22] Kailua-Kona (S. Oneo Bay) FRA	na	No indication of the type fishing activities permitted						
[22] Kailua-Kona (N. Keauhou) FRA	na	No indication of the type fishing activities permitted						
[22] Napo' opo' o-Honaunau FRA	na	No indication of the type fishing activities permitted						
[22] Ho'okena FRA	na	No indication of the type fishing activities permitted						
[22] Milioli'I FRA	na	No indication of the type fishing activities permitted						

[23] Piti MP	Seasonal fishing for <i>Siganus</i> & <i>Mulloidichthys</i> using cast nets and hook-and-line	0	1	0	0	1	0	Commercial
[24] [32] [44] Cerbere-Banyuls MNR	Commercial, recreational fishing, regulated SCUBA diving	0	1	0	0	1	1	Commercial
[25] Houtman-Abrolhos ROAs	Commercial fishing for rock lobster	0	1	1	0	1	1	Commercial
[27] Isla La Graciosa BZ	Hook and traditional fishing gear for (i) salema (<i>Sarpa salpa</i>), (ii) migratory pelagic species (tunids), (iii) guelds (minnows, “gueldera”) and morays (net drum). Traps and pots for crustaceans. Sport fishing using spinning tackle, hook-and-line	0	1	1	0	1	1	Commercial
[27] [49] Punta La Restiga BZ	Hook and traditional fishing gear for (i) salema (<i>Sarpa salpa</i>), (ii) migratory pelagic species (tunids), (iii) guelds (minnows, “gueldera”) and morays (net drum). Traps and pots for crustaceans. Sport fishing using spinning tackle, hook-and-line	0	1	1	0	1	1	Commercial
[29] Admiral Cockburn NPMR	Recreational hook-and-line fishing	0	1	1	0	0	na	Recreational
[30] Mtang'ata CFMZ	na							Commercial
[28] [31] Gulf of Castellammare FR	Artisinal fishing using trammel-gillnet gear, fish fry fishery for larval clupeoids, Fish Aggregating Device fishery for dolphinfish	0	1	1	0	1	1	Commercial
[33] Jurien Bay MP	Line fishing, netting , rock lobster & abalone fishing	0	1	1	0	1	1	Commercial
[34] CA-I	Any and all surface activities	0	1	1	0	1	1	Commercial
[34] [40] CA-II	Any and all surface activities (hook-and-line, midwater trawl)	0	1	1	0	1	1	Commercial
[35] [36] Western Gulf of Maine CA	Lobster pots, mid-water trawls , recreational hook-and-line gear	0	1	1	0	1	1	Commercial
[37] Patagonian scallop	na	No indication of the type fishing activities permitted						

management unit "Reclutas"								
[38] South Evvoikos Gulf	Trammel nets, gill nets , longlines	0	1	0	0	1	1	Commercial
[39] Two-headed Gully	Long-lining, single- pot crab fishing	0	1	1	0	1	1	Commercial
[41] Port Erin exclusion zone	Potting	0	1	1	0	1	1	Commercial
[42] Inshore Potting Agreement	Fishing with static gear	0	1	1	0	1	1	Commercial
[43] Commercial exclusion zones	Recreational fishing for lobster	0	1	1	0	0	na	Recreational
[45] Arnavon Island MCA	Line fishing	0	1	0	0	1	1	Commercial
[46] Glacier Bay National Park	Sport fishing & personal use fishing	0	1	1	0	0	na	Recreational
[47] Bell Island + Lime Kiln	Collection of salmon	0	1	1	0	1	1	Commercial
[48] Medes Island partial reserve	SCUBA diving, recreational fishing , boating, anchoring [artisinal fishing is regulated]	0	1	0	0	0	na	Recreational
[49] Isla de la Palma RFA	Commercial line fishing , tunid fishing, capture of small pelagic species as fishing bait, controlled SCUBA diving	0	1	0	0	1	1	Commercial
[49] Isla Graciosa RFA	SCUBA diving, fishing with hook-and-line, professional fishing with traditional nets for the capture of <i>Sarpa salpa</i> and migratory species	0	1	0	0	1	1	Commercial
[49] Punta de La restinga RFA	Artisinal fishery	0	1	0	0	1	1	Commercial
[50] Santa Catalina Inv NTRA	Line fishing	0	1	0	0	1	1	Commercial
[52] [58] Giannutri Island LPA	SCUBA diving, recreational fishing with longlines, gill nets , traps	0	1	0	0	0	na	Commercial
[53] [60] Ustica Island GR	SCUBA diving, artisinal fishing (limited to local boats), recreational fishing (limited to anglers)	0	1	0	0	1	1	Commercial
[53] [60] Ustica Island PR	Spearfishing , sea urchin harvesting	0	1	1	0	0	na	Recreational

[54] Mayor Island RFA	Recreational fishing	0	1	0	0	0	na	Recreational
[55] [62] Rottnest Island reserve	Recreational fishing, potting , SCUBA diving	0	1	1	0	1	1	Commercial
[56] recreational zone	Recreational fishing	0	1	0	0	0	na	Recreational
[57] Mpunguti MNR	Artisinal fishing using basket traps and gill netting	0	1	0	0	1	1	Commercial
[58] Capraia Is zone 2	Recreational fishing including angling, long lining, gill netting, traps	0	1	0	0	1	1	Commercial
[59] Charlotte Sound	Recreational fishing	0	1	0	0	0	na	Recreational
[61] Glover's Reef MRGUZ	Artisinal fishing , lobsters caught by gaffing	0	1	0	0	1	1	Commercial

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