

Standard Operating Procedure (SOP) #8

Conducting Marine Fish Surveys

Version 1.01 (July 15, 2021)

Change History

New Version #	Revision Date	Author	Changes Made	Reasons for Change	Previous Version #
1.01	7/15/2021	Kim Weisenborn, Sheila McKenna, Kelly Kozar	Minor updates to content. No anchoring	Updates to outdated SOP references. No longer anchor at any of parks where protocol implemented and standard 4 letter code with WoRMS used. Added field datasheets to appendix.	1.0

Only changes in this specific SOP will be logged here. Version numbers increase incrementally by hundredths (e.g., version 1.01, version 1.02) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0). Record the previous version number, date of revision, author of the revision, changes made, and reason for the change along with the new version number.

Purpose

This SOP explains how to conduct Marine Fish surveys to quantify species richness, fish abundance, and estimate total length to derive biomass. The SOP assumes that a monitoring site has been previously established as outlined in SOP #7 Selecting and Marking Subtidal Transect Locations, and will detail relocating the monitoring site, laying out the transect line, and performing the fish survey. This SOP is designed to be completed by a single diver with the co-located Benthic Marine Community protocol diver serving as a buddy. Any dive equipment mentioned in this SOP is intended to be used as a guideline only and use of this equipment, while shown to be effective, is not intended as an endorsement of any particular manufacturer or model.

General Procedure

The amount of time needed to complete a survey is approximately 15-20 minutes along a 25 m transect in ideal conditions making one to two passes along the transect. The number of passes is dependent on the survey region and the richness of the fish assemblage. With more depauperate fauna such as Hawaii only one pass is required. At NPSA and WAPA two passes are necessary to survey the greater number of fish species. All safety precautions will be followed as outlined in SOP

#3 Safety Protocol.

Equipment

For a complete list of equipment needed to carry out this procedure, refer to Appendix SOP 1.a of SOP #1 Before the Field Season. Observers will want to ensure that all equipment is ready prior to the scheduled survey dive day. For more detailed information on protocol prior to dive day, please see SOP #6 Pre-dive Equipment Preparations.

Field datasheets used for this protocol can be found in [Appendix SOP 8.a](#). Datasheets should be photocopied or printed onto plastic paper for use underwater.

Relocating the Monitoring Site

Step by step procedures:

1. Navigate by boat, or surface swim, to a transect start point using a GPS (Global Positioning System) unit which has the transect start point stored as a Waypoint. If surface swimming, put the GPS in a transparent waterproof container attached to a surface float (e.g. inner tube with dive flag) that has a line and a bottom weight to attach at the transect start point (see SOP #4 Using Garmin® GPS Units for information on using a GPS).
2. Approximately 3 meters from the site, carefully but quickly lower a surface float marker or Pelican® surface float from the boat with a bottom weight (~ 1 kg) so that it comes to rest as close as possible to the transect start pin.
3. If a permanent mooring buoy-line is available nearby, use it to securely tie off boat's bow line. Then, locate the deployed surface float by taking a compass bearing to it. If live boating be sure to follow all instructions of the boat captain and ensure communication, including hand signals and other procedures as per safety documents (e.g., SOP #3 Safety Protocol, GAR and JHA) are followed.
4. Check to ensure that all dive gear is in working order and that the primary and secondary regulators as well as power inflation devices are working correctly. This procedure also ensures that the divers' air is turned on.
5. Check to make sure that a transect tape and datasheets are in hand before entering the water or that other personnel are available to hand these items safely to the diver.
6. Put on dive gear and enter the water.
7. Retake a compass bearing to the surface float if needed. For detailed procedures on GPS and taking bearings see SOP #4 Using Garmin® GPS Units.
8. If a surface float is used, swim to the float and descend down the line.

Locate Transect Pin, Lay Transect Line and Conduct Fish Survey at Permanent Sites

Step by step procedures:

1. Underwater, locate the bottom float marker.
2. Both divers begin a systematic search for the transect start pin with one cable tie at KALA, NPSA, and WAPA or two cable ties at KAH0; clean the pin of fouling organisms as needed using gloved hand, scrub, or wire brush. If necessary, move the bottom float marker to the vicinity of the transect start pin.
3. Secure the brass clip end of the transect line/tape around the start pin.
4. Once the transect line is secured, take the known compass bearing to the end point of the transect, pulling the transect line out as you swim ensuring to keep the line as taut as possible.
5. For NPSA and WAPA the fish diver progresses down the transect at a constant speed and enumerates, to the lowest possible taxon, all fish greater than 20 cm total length. Total length (TL) of each fish is also estimated to the nearest centimeter.
6. On this first pass of the fish survey, the corridor for fish considered “on the transect” is 4 m wide and 4 m high but is visualized out to the end of the transect. Any fish outside this corridor is not included in the survey, though large or interesting fish should be noted.
7. Nomenclature should follow the latest accepted taxonomic name for the genus and species as per World Registry of Marine Species¹ and the PACN Benthic Marine and Marine Fish database four letter standard fish species code (Brown and Others 2020²)
8. Once at the end of the transect loop the line around the end pin twice so that it does not slip and loosen. The transect should now be installed such that the line is straight, suspended just above the bottom and taut over its entire length. This should reflect a runtime of approximately 5-8 minutes.
9. Turn and start the second pass of the survey by returning along the now laid transect line. On this section only fish less than 20 cm are counted and sized. The corridor is also reduced to 2 m wide and 4 m high. Again, note any large or noteworthy fish, but do not include them in the data. This section should take approximately 10-12 minutes, giving you a runtime to complete the survey of 15-20 minutes.

¹ An authoritative classification and catalogue of marine names, <http://www.marinespecies.org/> (accessed 15 July 2021).

² Pacific Island Network Benthic Marine and Marine Fish Monitoring Dataset, <https://irma.nps.gov/DataStore/Reference/Profile/2285036> (accessed 15 July 2021).

10. For more detail on the sampling design rationale, see Chapter 2 of the Marine Fish Monitoring Protocol³ and Brainard et al. (2007).
11. For the more depauperate fauna at KAHO and KALA, the transect dimensions are 25 m length X 5 m width. Only one pass is required and all fish are enumerated and sized within the corridor.
12. Once the fish (and benthic) surveys are complete, reel up the transect line.

Lay Transect Line and Conduct Fish Survey at Temporary Sites

Step by step procedures:

1. Navigate to the temporary site and deploy the Pelican® surface float with a bottom weight (~1 kg) or other surface marker buoy or have the divers disembark from the boat directly above the site.
2. Upon arriving at the temporary site, randomly determine the compass bearing of the transect that is parallel to the shoreline. This can be done on the boat or at the surface prior to beginning the dive. Typically, there are only 2 possible bearings along a depth contour, but this can be adjusted slightly when the divers descend down the float line and scan for homogeneous habitat along with the direction of the substrate contour.
3. As there are no pins at temporary transect locations, tie one end of the transect line securely around a dead coral colony or piece of rubble nearest the bottom weight. The tie-off location will be the first available piece of dead coral or rubble along the selected compass bearing of the transect.
4. Once the line is secured, swim the known compass bearing enumerating and sizing fish as before (see above) until 25 m of transect lines has been released. Pull the line taut and extend out several additional meters. Holding the tape taut, find a dead coral colony or piece of rubble suitable to tie off the line. Loop the line around the rubble twice so that it does not slip, causing it to loosen. Tie off securely. The transect should now be installed such that the line is straight, suspended just above the bottom and taut over its entire length. Make sure to record the compass bearing of the transect lines from the starting point to facilitate plotting of the transects in ArcGIS®.
5. Return along the transect documenting fish species and sizes as noted above in the permanent sites section.
6. In the case of KAHO and KALA, one pass is sufficient so once the fish diver has completed their survey then the benthic diver can commence their work.

³ Pacific Island Network, Marine Fish Monitoring Protocol, <https://irma.nps.gov/DataStore/DownloadFile/430121> (accessed 15 July 2021).

7. Once the fish (and benthic) surveys are complete, reel up the transect line.

General Considerations for Fish Surveys:

1. All fish should be counted only if they are completely within the boundaries of the transect.
2. Fish should be sized individually but with large schools the number of individuals in a range of sizes will suffice.
3. On the initial pass there is no maximum fish size, although very large fish (i.e. greater than 2 m) should be highlighted as they may confound the overall data.
4. On the return pass there is no minimum fish size because it is important to document new recruits. However, 3 cm may be the practical limit so minimum size will be revisited after several years of data collection.
5. Always try to look ahead for wary fish that may depart quickly from the area, but be careful that fish beyond the transect are not being surveyed.
6. Be careful to note if fish leave the area, so that they are not double counted if they return.
7. On the return pass for smaller fish, try to look into cracks, crevices, and corals to look for smaller, wary, and cryptic species.
8. On both sections of the survey swim fish should be identified to the species level. If species level is not possible try to identify to the lowest taxon possible and take a photograph of the specimen if practical and only if doing so will not disrupt further data collection.
9. Since each park has different fish assemblages, individual parks should customize the datasheet for data collection based on the most prevalent species encountered. Doing so speeds data collection and ensures less time is spent looking down on the datasheet.

Literature Cited

Brainard et al. 2007. Coral reef monitoring report. 2002 – 2006. NOAA—Coral Reef Ecosystem Division.

Pacific Island Network and Others. 2021. Pacific Island Network Benthic Marine and Marine Fish Monitoring Dataset. Pacific Island Network. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2285036> (accessed 15 July 2021).

Appendix SOP 8.a Marine Fish Monitoring datasheets

Each park uses a field datasheet customized for the fish found in their park. This appendix contains the fish datasheet and the list of species names and fish codes found on each park's datasheet.

Observer: _____ Site: **KAHO** Transect: _____ Type: T / F Date: _____ Bearing: _____ Depth: _____

Acanthuridae/Surgeonfish		CHOR		Monacanthidae/Filefishes		Scaridae/Parrotfish	
ACAC		CHQU		ALSC		CACA	
ACBL		CHRE		CADU		CAZO	
ACDU		CHUN		CASA		CHPE	
ACLE		FOFL		PEAS		CHSL	
ACNC		FOLO		Mullidae/Goatfish			
ACNF		HEPO		MUFL			
		HETH					
		HEDI		MUVA		SCPS	
		Cirrhitidae/Hawkfish				SCRU	
ACNR		AMBI		PACY			
ACOL		CIFA				Scorpaenidae/Scorpinfish	
ACTH		PAAR		PAIN		PTSP	
ACTR		PAFO		PAMU		SCDI	
		Holocentridae/Solderfish				Serranidae/Grouper	
ACXA		MYBE		PAPL		CEAR	
CTHA		MYKU		PARS			
CTST		NESA		Ostraciidae/Boxfish		Synodontidae/Lizardfish	
		SASP		OSME		SAFL	
		SATI		Pomacanthidae/Angel		SYDE	
		SAXA		CEFI		SYSP	
NABR		Kyphosidae/Chubs		CELO			
NAHE		KYBI		CEPO		Tetraodontidae/Pufferfish	
NALI		KYCI		Pomacentridae/Damsel		ARHI	
NAUN		CHUB		ABAB		ARME	
ZEFL		Labridae/Wrasses				CAAM	
		ANCH		ABVA		CACO	
		BOAL				CAJA	
		COGA		CHAC		Misc	
ZEVE		COVE				AENA	
Balistidae/Triggerfish		GOVA				AUCH	
BAPO		HAOR				BOMA	
MENI		INPA		CHAG		CAME	
MEVI		LAPH				CAOR	
		MAGE				CATY	
SUBU		NOTA				DEMA	
SUFR		OXBI		CHHA		DIHO	
XAAU		OXUN				DIHY	
Blenniidae/Blennies		PSEV		CHOV		ENPA	
CIVA		PSOC				FICO	
EXBR		PSTE				GYEU	
PLEW		PSCE				GYFL	
PLGO		STBA		CHVA		GYME	
Chaetodontidae/Butterflyfish		THDU				GYUN	
CHAU		THQU				MOAL	
CHKL		Lethrinidae/Emperors				PASC	
CHLI		MOGR		CHVE		PLAR	
CHLU		Lutjanidae/Snapper		DAAL		PRKA	
CHLT		APFU		PLIM		TROB	
CHMI		LUFU		PLJO		ZACO	
CHMU		LUKA		STFA			

Kaloko-Honokōhau National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Acanthuridae	Acanthurus achilles	ACAC
Acanthuridae	Acanthurus blochii	ACBL
Acanthuridae	Acanthurus dussumieri	ACDU
Acanthuridae	Acanthurus leucopareius	ACLE
Acanthuridae	Acanthurus nigricans	ACNC
Acanthuridae	Acanthurus nigrofuscus	ACNF
Acanthuridae	Acanthurus nigroris	ACNR
Acanthuridae	Acanthurus olivaceus	ACOL
Acanthuridae	Acanthurus thompsoni	ACTH
Acanthuridae	Acanthurus triostegus	ACTR
Acanthuridae	Acanthurus xanthopterus	ACXA
Acanthuridae	Ctenochaetus hawaiiensis	CTHA
Acanthuridae	Ctenochaetus strigosus	CTST
Acanthuridae	Naso brevirostris	NABR
Acanthuridae	Naso hexacanthus	NAHE
Acanthuridae	Naso lituratus	NALI
Acanthuridae	Naso unicornis	NAUN
Acanthuridae	Zebrasoma flavescens	ZEFL
Acanthuridae	Zebrasoma veliferum	ZEVE
Apogonidae	Pristiapogon kallopterus	PRKA
Aulostomidae	Aulostomus chinensis	AUCH
Balistidae	Balistes polylepis	BAPO
Balistidae	Melichthys niger	MENI
Balistidae	Melichthys vidua	MEVI
Balistidae	Sufflamen bursa	SUBU
Balistidae	Sufflamen fraenatum	SUFR
Balistidae	Xanthichthys auromarginatus	XAAU
Belonidae	Platybelone argalus	PLAR
Blenniidae	Cirripectes vanderbilti	CIVA
Blenniidae	Exallias brevis	EXBR
Blenniidae	Plagiotremus ewaensis	PLEW
Blenniidae	Plagiotremus goslinei	PLGO
Bothidae	Bothus mancus	BOMA
Caracanthidae	Caracanthus typicus	CATY
Carangidae	Carangoides orthogrammus	CAOR
Carangidae	Caranx melampygus	CAME
Carangidae	Decapterus macarellus	DEMA
Carcharhinidae	Triaenodon obesus	TROB
Chaetodontidae	Chaetodon auriga	CHAU
Chaetodontidae	Chaetodon kleinii	CHKL
Chaetodontidae	Chaetodon lineolatus	CHLI
Chaetodontidae	Chaetodon lunula	CHLU
Chaetodontidae	Chaetodon lunulatus	CHLT
Chaetodontidae	Chaetodon miliaris	CHMI
Chaetodontidae	Chaetodon multicinctus	CHMU

Kaloko-Honokōhau National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Chaetodontidae	Chaetodon ornatissimus	CHOR
Chaetodontidae	Chaetodon quadrimaculatus	CHQU
Chaetodontidae	Chaetodon reticulatus	CHRE
Chaetodontidae	Chaetodon unimaculatus	CHUN
Chaetodontidae	Forcipiger flavissimus	FOFL
Chaetodontidae	Forcipiger longirostris	FOLO
Chaetodontidae	Hemitaurichthys polylepis	HEPO
Chaetodontidae	Hemitaurichthys thompsoni	HETH
Chaetodontidae	Heniochus diphreutes	HEDI
Cirrhitidae	Amblycirrhitus bimacula	AMBI
Cirrhitidae	Cirrhitops fasciatus	CIFA
Cirrhitidae	Paracirrhites arcatus	PAAR
Cirrhitidae	Paracirrhites forsteri	PAFO
Diodontidae	Diodon holocanthus	DIHO
Diodontidae	Diodon hystrix	DIHY
Fistulariidae	Fistularia commersonii	FICO
Holocentridae	Myripristis berndti	MYBE
Holocentridae	Myripristis kuntee	MYKU
Holocentridae	Neoniphon sammara	NESA
Holocentridae	Sargocentron spiniferum	SASP
Holocentridae	Sargocentron tere	SATI
Holocentridae	Sargocentron xantherythrum	SAXA
Kyphosidae	Kyphosus bigibbus	KYBI
Kyphosidae	Kyphosus cinerascens	KYCI
Kyphosidae	Kyphosus sp	CHUB
Labridae	Anampses chrysocephalus	ANCH
Labridae	Bodianus albotaeniatus	BOAL
Labridae	Coris gaimard	COGA
Labridae	Coris venusta	COVE
Labridae	Gomphosus varius	GOVA
Labridae	Halichoeres ornatissimus	HAOR
Labridae	Iniistius pavo	INPA
Labridae	Labroides phthirophagus	LAPH
Labridae	Macropharyngodon geoffroy	MAGE
Labridae	Novaculichthys taeniourus	NOTA
Labridae	Oxycheilinus bimaculatus	OXBI
Labridae	Oxycheilinus unifasciatus	OXUN
Labridae	Pseudocheilinus evanidus	PSEV
Labridae	Pseudocheilinus octotaenia	PSOC
Labridae	Pseudocheilinus tetrataenia	PSTE
Labridae	Pseudojuloides cerasinus	PSCE
Labridae	Stethojulis balteata	STBA
Labridae	Thalassoma duperrey	THDU
Labridae	Thalassoma quinquevittatum	THQU
Lethrinidae	Monotaxis grandoculis	MOGR

Kaloko-Honokōhau National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Lutjanidae	Aphareus furca	APFU
Lutjanidae	Lutjanus fulvus	LUFU
Lutjanidae	Lutjanus kasmira	LUKA
Monacanthidae	Aluterus scriptus	ALSC
Monacanthidae	Cantherhines dumerilii	CADU
Monacanthidae	Cantherhines sandwichiensis	CASA
Monacanthidae	Pervagor aspricaudus	PEAS
Mullidae	Mulloidichthys flavolineatus	MUFL
Mullidae	Mulloidichthys vanicolensis	MUVA
Mullidae	Parupeneus cyclostomus	PACY
Mullidae	Parupeneus insularis	PAIN
Mullidae	Parupeneus multifasciatus	PAMU
Mullidae	Parupeneus pleurostigma	PAPL
Mullidae	Parupeneus sp	PARS
Muraenidae	Enchelycore pardalis	ENPA
Muraenidae	Gymnothorax eurostus	GYEU
Muraenidae	Gymnothorax flavimarginatus	GYFL
Muraenidae	Gymnothorax meleagris	GYME
Muraenidae	Gymnothorax undulatus	GYUN
Myliobatidae	Aetobatus narinari	AENA
Myliobatidae	Mobula alfredi	MOAL
Ostraciidae	Ostracion meleagris	OSME
Pinguipedidae	Parapercis schauinslandii	PASC
Pomacanthidae	Centropyge fisheri	CEFI
Pomacanthidae	Centropyge loricula	CELO
Pomacanthidae	Centropyge potteri	CEPO
Pomacentridae	Abudefduf abdominalis	ABAB
Pomacentridae	Abudefduf vaigiensis	ABVA
Pomacentridae	Chromis acares	CHAC
Pomacentridae	Chromis agilis	CHAG
Pomacentridae	Chromis hanui	CHHA
Pomacentridae	Chromis ovalis	CHOV
Pomacentridae	Chromis vanderbiltil	CHVA
Pomacentridae	Chromis verater	CHVE
Pomacentridae	Dascyllus albisella	DAAL
Pomacentridae	Plectroglyphidodon imparipennis	PLIM
Pomacentridae	Plectroglyphidodon johnstonianus	PLJO
Pomacentridae	Stegastes fasciolatus	STFA
Scaridae	Calotomus carolinus	CACA
Scaridae	Calotomus zonarchus	CAZO
Scaridae	Chlorurus perspicillatus	CHPE
Scaridae	Chlorurus spilurus	CHSL
Scaridae	Scarus psittacus	SCPS
Scaridae	Scarus rubroviolaceus	SCRU
Scorpaenidae	Pterois sphex	PTSP

Kaloko-Honokōhau National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Scorpaenidae	Scorpaenopsis diabolus	SCDI
Serranidae	Cephalopholis argus	CEAR
Synodontidae	Saurida flamma	SAFL
Synodontidae	Synodus dermatogenys	SYDE
Synodontidae	Synodus sp	SYSP
Tetraodontidae	Arothron hispidus	ARHI
Tetraodontidae	Arothron meleagris	ARME
Tetraodontidae	Canthigaster amboinensis	CAAM
Tetraodontidae	Canthigaster coronata	CACO
Tetraodontidae	Canthigaster jactator	CAJA
Zanclidae	Zanclus cornutus	ZACO

Observer: _____ Site: **KALA** Transect: _____ Type: T / F Date: _____ Bearing: _____ Depth: _____

Time: _____ Chain Length (m): _____ Transect Length (m): _____

Acanthuridae/Surgeonfish		DEMA		OXUN		Pomacentridae/Damsel	
ACAC		Chaetodontidae/Butterflyfish		PSOC		ABAB	
ACBL		CHAU		PSTE		ABSO	
ACDU		CHFR		PSCE		ABVA	
ACLE		CHLU		STBA		CHAG	
		CHMI		THBA		CHHA	
ACNF		CHMU		THDU		CHOV	
						CHVA	
		CHOR					
		CHQU				CHVE	
ACNR		FOFL		THTR		PLIM	
ACOL		FOLO		Lethrinidae/Emperors		PLJO	
		Cirrhitidae/Hawkfish		MOGR			
ACTR		CIFA		Lutjanidae/Snapper		STFA	
CTST		CIPI		APFU		Scaridae/Parrotfish	
		PAAR		APVI		CACA	
				LUFU		CHPE	
				LUKA		CHSL	
NABR			Monacanthidae/Filefishes		SCDU		
NAHE		PAFO		CASA		SCPS	
NALI		Holocentridae/Solderfish		PEAS			
		MYBE		PESP		SCRU	
NAUN		Kyphosidae/Chubs		Mullidae/Goatfish			
		CHUB		MUFL		Serranidae/Grouper	
ZEFL				MUVA		CEAR	
ZEVE		Labridae/Wrasses		PACY			
Balistidae/Triggerfish		ANCH		PAIN		Synodontidae/Lizardfish	
MENI		ANCU		PAMU		SYSP	
MEVI		BOAL				Tetraodontidae/Pufferfish	
RHRE				PAPL		CACO	
SUBU				PAPO		CAJA	
			COGA		Muraenidae		
SUFR		COVE		GYME		Misc	
Blenniidae/Blennies		GOVA		Ostraciidae/Boxfish		PRKA	
CIVA		HAOR		OSME		AUCH	
PLEW				Pomacanthidae/Angel		PRME	
PLGO		LAPH		APAR		ZACO	
Carangidae		MAGE		CEPO			
CAME		OXBI					

Kalaupapa National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Acanthuridae	Acanthurus achilles	ACAC
Acanthuridae	Acanthurus blochii	ACBL
Acanthuridae	Acanthurus dussumieri	ACDU
Acanthuridae	Acanthurus leucopareius	ACLE
Acanthuridae	Acanthurus nigrofuscus	ACNF
Acanthuridae	Acanthurus nigroris	ACNR
Acanthuridae	Acanthurus olivaceus	ACOL
Acanthuridae	Acanthurus triostegus	ACTR
Acanthuridae	Ctenochaetus strigosus	CTST
Acanthuridae	Naso brevirostris	NABR
Acanthuridae	Naso hexacanthus	NAHE
Acanthuridae	Naso lituratus	NALI
Acanthuridae	Naso unicornis	NAUN
Acanthuridae	Zebrasoma flavescens	ZEFL
Acanthuridae	Zebrasoma veliferum	ZEVE
Apogonidae	Pristiapogon kallopterus	PRKA
Aulostomidae	Aulostomus chinensis	AUCH
Balistidae	Melichthys niger	MENI
Balistidae	Melichthys vidua	MEVI
Balistidae	Rhinecanthus rectangulus	RHRE
Balistidae	Sufflamen bursa	SUBU
Balistidae	Sufflamen fraenatum	SUFR
Blenniidae	Cirripectes vanderbilti	CIVA
Blenniidae	Plagiotremus ewaensis	PLEW
Blenniidae	Plagiotremus goslinei	PLGO
Carangidae	Caranx melampygus	CAME
Carangidae	Decapterus macarellus	DEMA
Chaetodontidae	Chaetodon auriga	CHAU
Chaetodontidae	Chaetodon fremblii	CHFR
Chaetodontidae	Chaetodon lunula	CHLU
Chaetodontidae	Chaetodon miliaris	CHMI
Chaetodontidae	Chaetodon multicinctus	CHMU
Chaetodontidae	Chaetodon ornatissimus	CHOR
Chaetodontidae	Chaetodon quadrimaculatus	CHQU
Chaetodontidae	Forcipiger flavissimus	FOFL
Chaetodontidae	Forcipiger longirostris	FOLO
Cirrhitidae	Cirrhitops fasciatus	CIFA
Cirrhitidae	Cirrhitus pinnulatus	CIPI
Cirrhitidae	Paracirrhites arcatus	PAAR
Cirrhitidae	Paracirrhites forsteri	PAFO
Holocentridae	Myripristis berndti	MYBE
Kyphosidae	Kyphosus sp	CHUB
Labridae	Anampses chrysocephalus	ANCH
Labridae	Anampses cuvier	ANCU
Labridae	Bodianus albotaeniatus	BOAL

Kalaupapa National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Labridae	Coris gaimard	COGA
Labridae	Coris venusta	COVE
Labridae	Gomphosus varius	GOVA
Labridae	Halichoeres ornatissimus	HAOR
Labridae	Labroides phthirophagus	LAPH
Labridae	Macropharyngodon geoffroy	MAGE
Labridae	Oxycheilinus bimaculatus	OXBI
Labridae	Oxycheilinus unifasciatus	OXUN
Labridae	Pseudocheilinus octotaenia	PSOC
Labridae	Pseudocheilinus tetrataenia	PSTE
Labridae	Pseudojuloides cerasinus	PSCE
Labridae	Stethojulis balteata	STBA
Labridae	Thalassoma ballieui	THBA
Labridae	Thalassoma duperrey	THDU
Labridae	Thalassoma trilobatum	THTR
Lethrinidae	Monotaxis grandoculis	MOGR
Lutjanidae	Aphareus furca	APFU
Lutjanidae	Aprion virescens	APVI
Lutjanidae	Lutjanus fulvus	LUFU
Lutjanidae	Lutjanus kasmira	LUKA
Monacanthidae	Cantherhines sandwichiensis	CASA
Monacanthidae	Pervagor aspricaudus	PEAS
Monacanthidae	Pervagor spilosoma	PESP
Mullidae	Mulloidichthys flavolineatus	MUFL
Mullidae	Mulloidichthys vanicolensis	MUVA
Mullidae	Parupeneus cyclostomus	PACY
Mullidae	Parupeneus insularis	PAIN
Mullidae	Parupeneus multifasciatus	PAMU
Mullidae	Parupeneus pleurostigma	PAPL
Mullidae	Parupeneus porphyreus	PAPO
Muraenidae	Gymnothorax meleagris	GYME
Ostraciidae	Ostracion meleagris	OSME
Pomacanthidae	Apolemichthys arcuatus	APAR
Pomacanthidae	Centropyge potteri	CEPO
Pomacentridae	Abudefduf abdominalis	ABAB
Pomacentridae	Abudefduf sordidus	ABSO
Pomacentridae	Abudefduf vaigiensis	ABVA
Pomacentridae	Chromis agilis	CHAG
Pomacentridae	Chromis hanui	CHHA
Pomacentridae	Chromis ovalis	CHOV
Pomacentridae	Chromis vanderbilti	CHVA
Pomacentridae	Chromis verater	CHVE
Pomacentridae	Plectroglyphidodon imparipennis	PLIM
Pomacentridae	Plectroglyphidodon johnstonianus	PLJO
Pomacentridae	Stegastes fasciolatus	STFA

Kalaupapa National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Priacanthidae	Priacanthus meeki	PRME
Scaridae	Calotomus carolinus	CACA
Scaridae	Chlorurus perspicillatus	CHPE
Scaridae	Chlorurus spilurus	CHSL
Scaridae	Scarus dubius	SCDU
Scaridae	Scarus psittacus	SCPS
Scaridae	Scarus rubroviolaceus	SCRU
Serranidae	Cephalopholis argus	CEAR
Tetraodontidae	Canthigaster coronata	CACO
Tetraodontidae	Canthigaster jactator	CAJA
Zanclidae	Zanclus cornutus	ZACO

Date:	Transect:	Date:	Transect:
Obs:	Depth:	Obs:	Depth:
Acanthuridae ACNC ACNF ACOL CTCY CTSR NALI ZESC		Acanthuridae ACNC ACNF ACOL CTCY CTSR NALI ZESC	
Balistidae BAUN MEVI ODNI SUBU		Balistidae BAUN MEVI ODNI SUBU	
Blenniidae CIST ECBC MEAT		Blenniidae CIST ECBC MEAT	
Caesionidae CACE CATE		Caesionidae CACE CATE	
Cirrhitidae PAAR		Cirrhitidae PAAR	
Labridae GOVA HAHO HAOR LADI MAME PSEV PSHE THQU		Labridae GOVA HAHO HAOR LADI MAME PSEV PSHE THQU	
Lethrinidae GNAU MOGR		Lethrinidae GNAU MOGR	
Lutjanidae APFU		Lutjanidae APFU	
Mullidae MUFL MUVA PAMU		Mullidae MUFL MUVA PAMU	
Pomacanthidae CEFL PYDI		Pomacanthidae CEFL PYDI	
Pomacentridae CHIO CHMA CHXA		Pomacentridae CHIO CHMA CHXA	
Scaridae CHJA CHSL SCRU		Scaridae CHJA CHSL SCRU	
Serranidae CEUR CEAR		Serranidae CEUR CEAR	

National Park of America Samoa Marine Fish Species		
Family	Taxon Name	Species Code
Acanthuridae	Acanthurus nigricans	ACNC
Acanthuridae	Acanthurus nigrofuscus	ACNF
Acanthuridae	Acanthurus olivaceus	ACOL
Acanthuridae	Ctenochaetus cyanocheilus	CTCY
Acanthuridae	Ctenochaetus striatus	CTSR
Acanthuridae	Naso lituratus	NALI
Acanthuridae	Zebrasoma scopas	ZESC
Balistidae	Balistapus undulatus	BAUN
Balistidae	Melichthys vidua	MEVI
Balistidae	Odonus niger	ODNI
Balistidae	Sufflamen bursa	SUBU
Blenniidae	Cirripectes stigmaticus	CIST
Blenniidae	Ecsenius bicolor	ECBC
Blenniidae	Meiacanthus atrodorsalis	MEAT
Caesionidae	Caesio caerulea	CACE
Caesionidae	Caesio teres	CATE
Cirrhitidae	Paracirrhites arcatus	PAAR
Labridae	Gomphosus varius	GOVA
Labridae	Halichoeres hortulanus	HAHO
Labridae	Halichoeres ornatissimus	HAOR
Labridae	Labroides dimidiatus	LADI
Labridae	Macropharyngodon meleagris	MAME
Labridae	Pseudocheilinus evanidus	PSEV
Labridae	Pseudocheilinus hexataenia	PSHE
Labridae	Thalassoma quinquevittatum	THQU
Lethrinidae	Gnathodentex aureolineatus	GNAU
Lethrinidae	Monotaxis grandoculis	MOGR
Lutjanidae	Aphareus furca	APFU
Mullidae	Mulloidichthys flavolineatus	MUFL
Mullidae	Mulloidichthys vanicolensis	MUVA
Mullidae	Parupeneus multifasciatus	PAMU
Pomacanthidae	Centropyge flavissima	CEFL
Pomacanthidae	Pygoplites diacanthus	PYDI
Pomacentridae	Chromis iomelas	CHIO
Pomacentridae	Chromis margaritifer	CHMA
Pomacentridae	Chromis xanthura	CHXA
Scaridae	Chlorurus japanensis	CHJA
Scaridae	Chlorurus spilurus	CHSL
Scaridae	Scarus rubroviolaceus	SCRU
Serranidae	Cephalopholis argus	CEAR
Serranidae	Cephalopholis urodeta	CEUR

Observer: _____ Site: **WAPA** Transect: _____ Type: T / F Date: _____ Bearing: _____ Depth: _____

Acanthuridae/Surgeonfish		HEMO		OXUN		CHTY	
ACNC		HESI		PSEV			
ACNF		HEVA		PSHE			
		Cirrhitidae/Hawkfish		PSMO		DATR	
		CIFL		PTCR		PLJO	
ACNR		CIFA		STBA		PLLA	
ACOL		PAAR		STBN		POPA	
ACPY		PAFO		STST		POVA	
ACTH		Gobiidae		STTR			
CTBI		AMGU		THAM			
CTCY		ISDE		THHA		POEX	
CTSP		VAST		THLU		POGU	
		Holocentridae/Solderfish		THPU		STFA	
CTSR		MYAD		THQU		Ptereleotridae/Dartfish	
NAAN		MYBE		THTR		NEMA	
NALI		MYKU		Lethrinidae/Emperors		PTEV	
		MYMU		GNAU		PTHE	
NAUN		MYSP		LEOL		Scaridae	
NAVL		NESA		MOGR		CACA	
ZEFL		NESP		Lutjanidae/Snapper		CEBL	
ZEVE		SACA		APFU		CHMC	
Apogonidae		SADI		APVI		CHSL	
APAN		SAPU		LUFU			
OSNI		SAPP		LUGI		HILO	
OSNO		SASP		LUKA		SCFO	
OSSE		SATI		LUMO		SCGL	
Balistidae/Triggerfish		Labridae/Wrasses		MAMA		SCOV	
BAUN		ANME		Malacanthidae/Blanquillo		SCPS	
BAVI		ANTW		MABR		SCSC	
MEVI		BOAX		Monacanthidae		Scorpaenidae/Scorpinfish	
ODNI		CHCL		AMSC		PTRA	
SUBU		CHFA		PAPR		SCDI	
SUCH		CHOX		PEJA		SCVE	
XAAU		CHTL		Mullidae/Goatfish		Serranidae/Grouper	
Blenniidae/Blennies		CHIN		MUFL		CEUR	
CIST		CIKA		MUVA		EPFA	
ECBC		COAY		PABA		EPME	
MEAT		CODO		PACY		Siganidae	
PLLD		COGA		PAMU		SIAR	
		EPIN		Pomacanthidae/Angelfish		Synodontidae/Lizardfish	
PLTA		GOVA		CEFL		SYBI	
Chaetodontidae/Butterflyfish		HABI		CESH		SYVA	
CHAU		HAHO		POIM		Tetraodontidae/Pufferfish	
CHBE		HAMT		PYDI		ARNI	
CHCI		HAMA		Pomacentridae/Damsel		CAAM	
CHLU		HAML		ABSX		CASO	
CHLT		HAOR		AMCU		Misc	
CHMR		HATR		AMCH		CACE	
CHOR		HEFA		AMCL		PTTI	
CHPU		HEME		AMPE		CAME	
CHRE		LABI		CHAC		GYJA	
CHUL		LADI		CHAG		SCLI	
CHUN		LAXA		CHAL		OSME	
FOFL		MAME		CHMA		PEOU	
FOLO		NOTA		CHXA		PACL	
HEPO		OXBI		CHBR		ZACO	
HECH		OXDI					

War in the Pacific National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Acanthuridae	Acanthurus nigricans	ACNC
Acanthuridae	Acanthurus nigrofuscus	ACNF
Acanthuridae	Acanthurus nigroris	ACNR
Acanthuridae	Acanthurus olivaceus	ACOL
Acanthuridae	Acanthurus pyroferus	ACPY
Acanthuridae	Acanthurus thompsoni	ACTH
Acanthuridae	Ctenochaetus binotatus	CTBI
Acanthuridae	Ctenochaetus cyanocheilus	CTCY
Acanthuridae	Ctenochaetus sp	CTSP
Acanthuridae	Ctenochaetus striatus	CTSR
Acanthuridae	Naso annulatus	NAAN
Acanthuridae	Naso lituratus	NALI
Acanthuridae	Naso unicornis	NAUN
Acanthuridae	Naso vlamingii	NAVL
Acanthuridae	Zebrasoma flavescens	ZEFL
Acanthuridae	Zebrasoma veliferum	ZEVE
Apogonidae	Apogon angustatus	APAN
Apogonidae	Ostorhinchus nigrofasciatus	OSNI
Apogonidae	Ostorhinchus novemfasciatus	OSNO
Apogonidae	Ostorhinchus selas	OSSE
Balistidae	Balistapus undulatus	BAUN
Balistidae	Balistoides viridescens	BAVI
Balistidae	Melichthys vidua	MEVI
Balistidae	Odonus niger	ODNI
Balistidae	Sufflamen bursa	SUBU
Balistidae	Sufflamen chrysopterum	SUCH
Balistidae	Xanthichthys auromarginatus	XAAU
Blenniidae	Cirripectes stigmaticus	CIST
Pomacentridae	Abudefduf sexfasciatus	ABSX
Blenniidae	Meiacanthus atrodorsalis	MEAT
Blenniidae	Plagiotremus laudandus	PLLD
Blenniidae	Plagiotremus tapeinosoma	PLTA
Caesionidae	Caesio caerulaurea	CACE
Caesionidae	Pterocaesio tile	PTTI
Carangidae	Caranx melampygus	CAME
Chaetodontidae	Chaetodon auriga	CHAU
Chaetodontidae	Chaetodon bennetti	CHBE
Chaetodontidae	Chaetodon citrinellus	CHCI
Chaetodontidae	Chaetodon lunula	CHLU
Chaetodontidae	Chaetodon lunulatus	CHLT
Chaetodontidae	Chaetodon mertensii	CHMR
Chaetodontidae	Chaetodon ornatissimus	CHOR
Chaetodontidae	Chaetodon punctatofasciatus	CHPU
Chaetodontidae	Chaetodon reticulatus	CHRE
Chaetodontidae	Chaetodon ulietensis	CHUL

War in the Pacific National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Chaetodontidae	Chaetodon unimaculatus	CHUN
Chaetodontidae	Forcipiger flavissimus	FOFL
Chaetodontidae	Forcipiger longirostris	FOLO
Chaetodontidae	Hemitaurichthys polylepis	HEPO
Chaetodontidae	Heniochus chrysostomus	HECH
Chaetodontidae	Heniochus monoceros	HEMO
Chaetodontidae	Heniochus singularius	HESI
Chaetodontidae	Heniochus varius	HEVA
Cirrhitidae	Cirrhitichthys falco	CIFL
Cirrhitidae	Cirrhitops fasciatus	CIFA
Cirrhitidae	Paracirrhites arcatus	PAAR
Cirrhitidae	Paracirrhites forsteri	PAFO
Gobiidae	Amblyeleotris guttata	AMGU
Gobiidae	Istigobius decoratus	ISDE
Gobiidae	Valenciennea strigata	VAST
Holocentridae	Myripristis adusta	MYAD
Holocentridae	Myripristis berndti	MYBE
Holocentridae	Myripristis kuntee	MYKU
Holocentridae	Myripristis murdjan	MYMU
Holocentridae	Myripristis sp	MYSP
Holocentridae	Neoniphon sammara	NESA
Labridae	Cheilinus trilobatus	CHTL
Holocentridae	Sargocentron caudimaculatum	SACA
Holocentridae	Sargocentron diadema	SADI
Holocentridae	Sargocentron punctatissimum	SAPU
Scaridae	Chlorurus spilurus	CHSL
Holocentridae	Sargocentron spiniferum	SASP
Holocentridae	Sargocentron tiere	SATI
Labridae	Anampses melanurus	ANME
Labridae	Anampses twistii	ANTW
Labridae	Bodianus axillaris	BOAX
Labridae	Cheilinus chlorourus	CHCL
Labridae	Cheilinus fasciatus	CHFA
Labridae	Cheilinus oxycephalus	CHOX
Pomacentridae	Chrysiptera traceyi	CHTY
Labridae	Cheilio inermis	CHIN
Labridae	Cirrhilabrus katherinae	CIKA
Labridae	Coris aygula	COAY
Labridae	Coris dorsomacula	CODO
Labridae	Coris gaimard	COGA
Labridae	Epibulus insidiator	EPIN
Labridae	Gomphosus varius	GOVA
Labridae	Halichoeres biocellatus	HABI
Labridae	Halichoeres hortulanus	HAHO
Blenniidae	Ecsenius bicolor	ECBC

War in the Pacific National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Labridae	Halichoeres marginatus	HAMA
Labridae	Halichoeres melanurus	HAML
Labridae	Halichoeres ornatissimus	HAOR
Labridae	Halichoeres trimaculatus	HATR
Labridae	Hemigymnus fasciatus	HEFA
Labridae	Hemigymnus melapterus	HEME
Labridae	Labroides bicolor	LABI
Labridae	Labroides dimidiatus	LADI
Labridae	Labropsis xanthonota	LAXA
Labridae	Macropharyngodon meleagris	MAME
Labridae	Novaculichthys taeniourus	NOTA
Labridae	Oxycheilinus bimaculatus	OXBI
Labridae	Oxycheilinus digramma	OXDI
Labridae	Oxycheilinus unifasciatus	OXUN
Labridae	Pseudocheilinus evanidus	PSEV
Labridae	Pseudocheilinus hexataenia	PSHE
Labridae	Pseudodax moluccanus	PSMO
Labridae	Pteragogus cryptus	PTCR
Labridae	Stethojulis balteata	STBA
Labridae	Stethojulis bandanensis	STBN
Labridae	Stethojulis strigiventer	STST
Labridae	Stethojulis trilineata	STTR
Labridae	Thalassoma amblycephalum	THAM
Labridae	Thalassoma hardwicke	THHA
Labridae	Thalassoma lutescens	THLU
Labridae	Thalassoma purpureum	THPU
Labridae	Thalassoma quinquevittatum	THQU
Labridae	Thalassoma trilobatum	THTR
Lethrinidae	Gnathodentex aureolineatus	GNAU
Lethrinidae	Lethrinus olivaceus	LEOL
Lethrinidae	Monotaxis grandoculis	MOGR
Lutjanidae	Aphareus furca	APFU
Lutjanidae	Aprion virescens	APVI
Lutjanidae	Lutjanus fulvus	LUFU
Lutjanidae	Lutjanus gibbus	LUGI
Lutjanidae	Lutjanus kasmira	LUKA
Lutjanidae	Lutjanus monostigma	LUMO
Lutjanidae	Macolor macularis	MAMA
Malacanthidae	Malacanthus brevirostris	MABR
Monacanthidae	Amanses scopas	AMSC
Monacanthidae	Paraluteres prionurus	PAPR
Monacanthidae	Pervagor janthinosoma	PEJA
Mullidae	Mulloidichthys flavolineatus	MUFL
Mullidae	Mulloidichthys vanicolensis	MUVA
Mullidae	Parupeneus barberinus	PABA

War in the Pacific National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Mullidae	Parupeneus cyclostomus	PACY
Mullidae	Parupeneus multifasciatus	PAMU
Muraenidae	Gymnothorax javanicus	GYJA
Nemipteridae	Scolopsis lineata	SCLI
Ostraciidae	Ostracion meleagris	OSME
Pempheridae	Pempheris oualensis	PEOU
Pinguipedidae	Parapercis clathrata	PACL
Pomacanthidae	Centropyge flavissima	CEFL
Pomacanthidae	Centropyge shepardi	CESH
Pomacanthidae	Pomacanthus imperator	POIM
Pomacanthidae	Pygoplites diacanthus	PYDI
Labridae	Halichoeres margaritaceus	HAMT
Pomacentridae	Amblyglyphidodon curacao	AMCU
Pomacentridae	Amphiprion chrysopterus	AMCH
Pomacentridae	Amphiprion clarkii	AMCL
Pomacentridae	Amphiprion perideraion	AMPE
Pomacentridae	Chromis acares	CHAC
Pomacentridae	Chromis agilis	CHAG
Pomacentridae	Chromis alpha	CHAL
Pomacentridae	Chromis margaritifer	CHMA
Pomacentridae	Chromis xanthura	CHXA
Pomacentridae	Chrysiptera brownriggii	CHBR
Holocentridae	Neoniphon sp	NESP
Pomacentridae	Dascyllus trimaculatus	DATR
Pomacentridae	Plectroglyphidodon johnstonianus	PLJO
Pomacentridae	Plectroglyphidodon lacrymatus	PLLA
Pomacentridae	Pomacentrus pavo	POPA
Pomacentridae	Pomacentrus vaiuli	POVA
Pomacentridae	Pomachromis exilis	POEX
Pomacentridae	Pomachromis guamensis	POGU
Pomacentridae	Stegastes fasciolatus	STFA
Ptereleotridae	Nemateleotris magnifica	NEMA
Ptereleotridae	Ptereleotris evides	PTEV
Ptereleotridae	Ptereleotris heteroptera	PTHE
Scaridae	Calotomus carolinus	CACA
Scaridae	Cetoscarus bicolor	CEBL
Scaridae	Chlorurus microrhinos	CHMC
Holocentridae	Sargocentron sp	SAPP
Scaridae	Hipposcarus longiceps	HILO
Scaridae	Scarus forsteni	SCFO
Scaridae	Scarus globiceps	SCGL
Scaridae	Scarus oviceps	SCOV
Scaridae	Scarus psittacus	SCPS
Scaridae	Scarus schlegeli	SCSC
Scorpaenidae	Pterois radiata	PTRA

War in the Pacific National Historical Park Marine Fish Species		
Family	Taxon Name	Species Code
Scorpaenidae	Scorpaenopsis diabolus	SCDI
Scorpaenidae	Scorpaenopsis venosa	SCVE
Serranidae	Cephalopholis urodeta	CEUR
Serranidae	Epinephelus fasciatus	EPFA
Serranidae	Epinephelus merra	EPME
Siganidae	Siganus argenteus	SIAR
Synodontidae	Synodus binotatus	SYBI
Synodontidae	Synodus variegatus	SYVA
Tetraodontidae	Arothron nigropunctatus	ARNI
Tetraodontidae	Canthigaster amboinensis	CAAM
Tetraodontidae	Canthigaster solandri	CASO
Zanclidae	Zanclus cornutus	ZACO