

# APPENDIX A

## CATALOGUE OF FISHING GEAR AND IMPACTS TO ESSENTIAL FISH HABITAT

## Catalogue of Fishing Gear and Impacts on EFH

### DEFINITIONS

#### **Hook and Line Methods**

**Albacore trolling** means fishing consisting of towing or dragging multiple lines with artificial lures with a vessel underway.

**Buoy gear** means fishing gear consisting of a float and one or more lines suspended therefrom. A hook or hooks are on the lines at or near the end. The float and line(s) drift freely and are retrieved periodically to remove catch and rebait hooks.

**Casting** means fishing from shore or a vessel using a pole and casting reel. Includes techniques such as whipping, jigging, dunking, slide baiting, fly-fishing or any technique using a pole and line.

**Deep-sea handline** means fishing from a vessel using a vertical mainline with single/multiple baited hooks and weight, lowered near the bottom.

**Flagline** (Longline) means fishing with a mainline one nautical mile or longer in length, suspended horizontally from the surface by floats from which branch lines with baited hooks are attached.

**Floatline** means fishing using a horizontal mainline, less than one nautical mile in length and suspended from the ocean surface with floats, from which leaders with baited hooks are suspended.

**Handline** means fishing gear that is set and pulled by hand and consists of one vertical line to which may be attached leader lines with hooks.

**Hook and line** means one or more hooks attached to one or more lines (can include a troll). Bandit gear means vertical hook and line gear with rods that are attached to the vessel when in use. Lines are retrieved by manual, electric, or hydraulic reels.

**Ika-Shibi** means fishing (mainly at night) using a vertical mainline with high-test monofilament leader, from which is suspended a baited hook. Muhe'e ("true squid") or opelu typically used as bait.

**Inshore handline** same as deep-sea handline to include artificial lures (damashi). With the exception of fishing tackle usually consisting of lighter gear than deep-sea handline.

**Kaka line** (set line) means fishing with a mainline less than one nautical mile in length from which branch lines of baited hooks are attached. Line is set horizontally, on or near the bottom, or in shallow mid water.

**Longline** means a line that is deployed horizontally and to which gangions and hooks or pots are attached. Longlines can be stationary, anchored, or buoyed lines that may be hauled manually, electrically, or hydraulically.

**Palu Ahi** (similar to “Ika-shibi”) means fishing (usually daytime) with a baited hook and cut pieces of bait (“chum”). This method also includes the use of “danglers” for reporting purposes.

**Pole and line** (Aku boat) means fishing for aku (skipjack tuna) using live bait and artificial lures. Fish are hooked with pole and line, using a barb less hook (feathered, baited or not).

**Rod and reel** means a hand-held (including rod holder) fishing rod with a manually or electrically operated reel attached.

**Tuna handline** means a mixture of fishing methods used to catch pelagic species primarily on offshore sea-mounts and near NOAA weather buoys. It is generally a combination of hand-lining, trolling, and baiting techniques used simultaneously.

**Trolling** means fishing by towing or dragging line(s) with artificial lure(s) or dead or live bait using a sail, surf or motor-powered vessel.

- a) Trolling with Bait: Trolling with bait (dead or alive).
- b) Trolling with Lures: Trolling with artificial lures.
- c) Trolling with Green Stick: Trolling with the bird, green stick and danglers.

#### **Nets:**

*Nets fishing* includes Gill net, Fence net, Lay net, Cross net, Seine net, Drag net, Bull, pen, Pen, Akule net, Bag net, Opelu net, Hukilau net, Kona crab net, loop net, Lobster net, Throw net, Cast net, Purse Seine, Surround net, Bait net, Shrimp trawl

**Aquarium Collecting** means fishing with small meshed nets, except throw-nets, and small meshed traps for aquatic life that is kept alive for display.

**Bait net** means a seine net with very small mesh used to catch certain kinds of fish for bait.

**Barrier net** means a small-mesh net used to capture coral reef or coastal pelagic fishes.

**Bullpen trap** means net(s) fixed in position to form a large stationary enclosure.

**Bully net** means a circular frame attached at right angles to a pole and supporting a conical bag of webbing.

**Cast net** means a circular net with weights attached to the perimeter.

**Cast net (Talaya)** means a circular net with weights or chain around the perimeter which is thrown for the purpose of taking or capturing marine animals.

**Crab net** means a small lift net that is used to catch crabs.

**Dip net** means a small mesh bag, sometimes attached to a handle, shaped and framed in various ways. It is operated by hand or partially by mechanical power to capture the fish.

**Gillnet** means a panel of netting, suspended vertically in the water by floats along the top and weights along the bottom, to entangle fish that attempt to pass through it.

**Gill net** (fence net, cross net, lay net, and pai pai net, etc.) means a curtain like net suspended in the water with mesh openings large enough to permit only the heads of the fish to pass through, ensnaring them around the gills when they attempt to escape.

**Gill net (tekin)** means any net in which the mechanism for capturing fish is entanglement.

**Hoop net** means a cone-shaped net having throats and flues stretched over a series of rings or hoops for support.

**Kona crab net** means a fine stranded netting stretched over a metal frame to form a flat net. Multiple baited nets are set on sandy bottoms trapping crabs when they get entangled in the mesh.

**Lift net** means a net that captures fish by raising the net from beneath a school of fish. Normally fish are encouraged over and into the net with chum.

**Lampara net** means a surround net with the sections of netting made and joined to create bagging. It is hauled with purse rings and is generally much smaller in size than a purse seine net.

**Lobster net** means a net with large eye mesh used to entangle lobsters.

**Purse seine** means a floated and weighted encircling net that is closed by means of a drawstring threaded through rings attached to the bottom of the net.

**Purse seine net** means a net that is used to surround a school of fish and is closed by drawing the bottom of the net together to form a bag.

**Set net** means a stationary, buoyed, and anchored gill net.

**Seine net** means a net with long narrow wings, that is rigged with floats and weights.

**Seine net** (hukilau, beach seine, dragnet, pen, surround, etc.) Fishing with a net by moving it through the water to surround fish by corralling and trapping them within the walls of the net.

**Surround net (Chenchulum Managam)** means any vertical net set to act as a barrier to detain fish in which the fish are not gilled by the net. A surround net is not pursed and therefore is not a type of purse seine.

**Throw net** means a round shaped weighted outer perimeter net that is thrown over fish.

**Trammel net** means a net consisting of two or more panels of netting, suspended vertically in the water column by a common float line and a common weight line. One panel of netting has a larger mesh size than the other(s) in order to entrap fish in a pocket.

**Trawl** means a cone or funnel-shaped net that is towed through the water, and can include a pair trawl that is towed simultaneously by two boats.

**Trawl** (shrimp trawl) means a net that is dragged through the water by the vessel.

### **Traps:**

*Trap fishing* means fishing with any of the various fishing devices made into the shape of a box, or enclosure, with one or more openings that allow marine life to enter but keep them from leaving.

**Fish trap** means a trap primarily used to target fish.

**Lobster trap** means a trap primarily used to target lobsters.

**Crab trap** means a trap primarily used to target crabs.

**Pot** means trap.

**Shrimp trap** means a trap primarily used to target shrimp.

**Trap** means a portable, enclosed device with one or more gates or entrances and one or more lines attached to surface floats. Also called a pot.

#### **Other Methods:**

**Black coral dive** means divers harvesting black coral using SCUBA or re-breathers.

**Diving** Fishing while swimming free dive (skin diving) or swimming with the assistance of compressed gases (SCUBA, re-breathers, etc.). Examples are lobster or namako diving. Does not include diving with a spear (see spearfishing), a net (see various nets), or for limu or opihi (see handpicking).

**Fish Aggregation Device (FAD)** means any device deployed in the water or water column that is intended to attract and increase the potential yield of fish species. FADs can be anchored or free floating and include devices such as: rafts, buoys, plastic bottles, steel canisters, marine debris and artificial reefs. The use of FADs have generally been associated with pelagic fisheries however, the use of this method is now being expanded to target coral reef species occurring at Penguin Banks in the Main Hawaiian Islands.

**Fishpond** means an enclosed or semi-enclosed coastal body of water used for fish culture. Fishponds are typically stocked with pua (juvenile striped mullet) or enter through a makaha (gate).

**Hand harvest** means harvesting by hand.

**Handpicked** means hand harvesting marine life by various methods.

**Powerhead** means any device with an explosive charge, usually attached to a spear gun, spear, pole, or stick, that may or may not fire a projectile upon contact.

**Tangle net dredge** means dredge gear consisting of weights and flimsy netting that hangs loosely in order to immediately entangle fish.

**Slurp gun** means a tube-shaped suction device that operates somewhat like a syringe by sucking up the fish.

**Snare** means a device consisting of a pole to which is attached a line forming at its end a loop with a running knot that tightens around the fish when the line is pulled.

**Spear** means a sharp, pointed, or barbed instrument on a shaft. Spears can be operated manually or shot from a gun or sling.

**Spearfishing** means fishing with a shaft with one or more sharpened points at one end usually associated with diving. Includes bow and torch fishing and bluewater spearfishing. Spearfishing in federal waters primarily occur at Penguin Bank in the Main Hawaiian Islands.

**Submersible** means a manned or unmanned device that functions or operates primarily underwater and is used to harvest fish, i.e., precious corals, with mechanical arms.

**Submersible** (for precious coral) means a vessel (manned or unmanned) capable of diving and/or remaining underwater for selectively harvesting deepwater precious corals.

#### **Pelagic Methods**

Aku boat, Pole and line, Ahi boat, Flagline, Longline, Ikashibi (tuna handline), Paluahi (tuna handline), Trolling

#### **Benthic Methods**

Deepsea handline, Bottom handline, Inshore handline, Kaka line, Set line

#### **Diving Methods**

Spearing, Lobster dive, Coral dive

### **IMPACT DEFINITIONS**

#### **Impacts:**

##### *Criteria for Ranking*

#### **Low:**

Gear and/or method as used has no significant impact on habitat.

#### **Medium:**

Gear and/or method as used may have the potential for minor impacts on habitat, however, impacts do not adversely impact EFH.

**High**

Gear and/or method as used may result in impacts to habitat that do result in a reduction in quantity or quality of EFH. To the extent practicable, these impacts must be minimized through management measures.

**Bycatch**

Bycatch is a direct measurement of a gear selectivity.

**Criteria for Ranking****Low:**

Gear and/or method as used is able to target specific individual species or species complexes. Fishermen are able to target species with a high degree of certainty. Non-target species generally are able to avoid the gear or capture. If gear interaction occurs, the non-target species are generally able to escape capture. Generally most of the catch are retained. The overall mortality of incidentally caught species is low.

**Medium:**

Gear and/or method as used is able to target specific species assemblages. Gear includes specific features that allow for incidentally caught species to escape. Gear features and method of use are capable of specific modifications that enable fishermen to target specific species and size classes. Additionally, gear design may be modified to exclude undesirable species. Further, the gear is capable of being deployed to target specific species. Generally a majority of the catch are retained. The overall mortality of incidentally caught species is generally low to moderate.

**High:**

Gear and/or method as used is has limited ability to target specific species assemblages. Gear usually does not include specific mechanism(s) that allow for incidentally caught species to escape. Gear design features and method of use are capable of only limited modifications that enable the fishermen to target specific species and size classes. The use of gear may result in significant amounts of incidentally caught species being discarded. Mortality of incidentally caught species is typically moderate to high.



Gear		Impacts to Habitat			Bycatch		
		Low	Medium	High	Low	Medium	High
HOOK and LINE							
Trolling	Trolling w/bait: (Dead or Alive)	✓			✓		
	Trolling w/Lures: (artificial lures)	✓			✓		
	Trolling w/Green stick)	✓			✓		
Handline							
Bottomfish gear							
Deep-sea handline		✓			✓		
Inshore handline		✓				✓	
Kaka line			✓			✓	
Pelagic gear							
Ika-Shibi		✓			✓		
Palu Ahi		✓			✓		
Longline		✓				✓	
Pole and Line		✓				✓	
Rod and Reel		✓				✓	
NET							
Gill Net							
moe moe net				✓		✓	

Gear		Impacts to Habitat			Bycatch		
		Low	Medium	High	Low	Medium	High
<b>Surround Net</b> (Fence net, surround net, pai pai net, laynet etc., attended)							
Akule Surround Net			✓			✓	
Opelu Net			✓			✓	
Purse seine		✓				✓	
Seine Net (Hukilau net)				✓			✓
Hoop net		✓			✓		
Kona crab net		✓			✓		
Trawl				✓			✓
Bait net		✓			✓		
Barrier net			✓			✓	
Cast net			✓		✓		
Crab net		✓			✓		
Dip net		✓				✓	
Lobster net			✓		✓		
TRAP							
Fish Trap (deepwater)			✓			✓	
Fish Trap (handset)		✓				✓	
Lobster Trap		✓			✓		
Crab Trap		✓			✓		
Shrimp Trap			✓			✓	

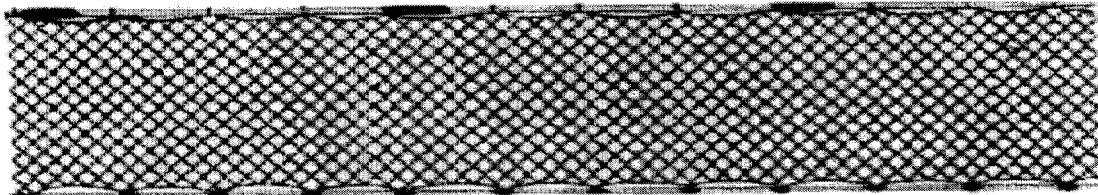
Gear		Impacts to Habitat			Bycatch		
		Low	Medium	High	Low	Medium	High
OTHER							
Diving		✓			✓		
Hand harvest		✓			✓		
handpicked		✓			✓		
Slurp gun		✓			✓		
Snare		✓			✓		
Spear fishing		✓			✓		
Submersible		✓			✓		
Tangle nets				✓		✓	

# Fishing Gear Catalogue

## NET

**Gear Type:** Akule Surround Net

**Diagram of typical gear:**

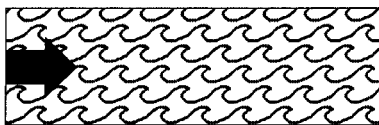


### Deployment/retrieval:

Akule is known as atule in American Samoa, atulai in Guam and akule in Hawaii, Bigeye scad *Selar crumenophthalmus*) and is abundant in the Pacific Islands. Akule surround nets are constructed of nylon and range in length from 1250-5000 feet and are 40 feet high. The typical mesh size used in net construction is 1 ½ inches. The net is a single panel with a floats on the top and a leadline on the bottom.

Some fishermen use airplanes flying at low altitudes (1,000-1,500 ft) to spot schools of fish and direct the vessel where to set the net. Once a school is located in calm waters with soft bottom, a skiff is used to surround the fish with the net. The skiff is powered by oars, as a motor would scare the fish. After the school is surrounded, several scuba divers are sent down to bring the lead lines together and secure the nets lead lines together. The divers then scare the fish to one side of the net and divide the net in half. The process is repeated until the net is about one fourth of its original size. It is then taken to the vessel and the fish are brailed aboard. In order to successfully entrap the school, nets must be suspended through the entire water column from surface to bottom. The depth fished is approximately 20 ft, not deeper than 40 ft.

### Habitat Impacts:



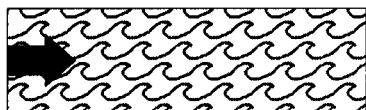
Low Med High

Surround nets for akule have low impact on coral reef habitat. Akule are found in shallow, nearshore waters of bays and harbors. Fishing usually occurs seaward of the reef in fairly shallow sandy areas. Akule fishermen actively avoid substrates with high or varied benthic relief because of the difficulty such areas present to successfully encircle

and capture the targeted school of fish. In areas of high relief or numerous coral outcrops, the net would become entangled, damaging both the net itself and allowing the

school of akule to escape. Use of scuba divers to retrieve the net further minimizes potential impacts to benthic habitat, including coral reefs.

**Bycatch:**



Low

Med

High

Deployment and retrieval of akule nets make this gear relatively selective. Substantial effort is made prior to deployment of the net to identify a school of akule in a suitable area, sandy flat sub-straights. During net retrieval, efforts are made by scuba divers to cull out any unwanted

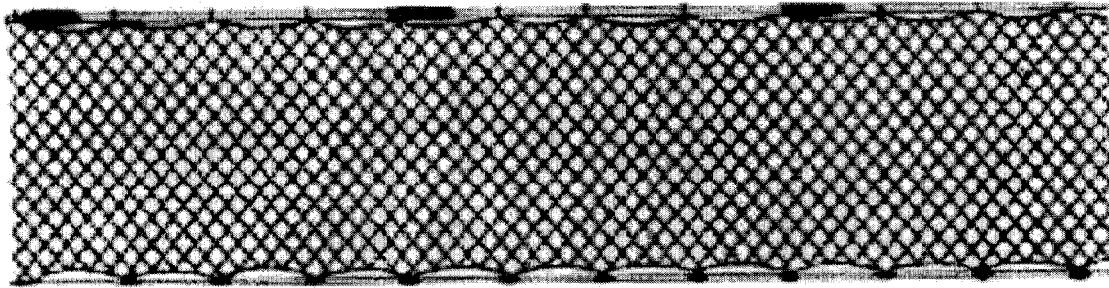
species that may have been inadvertently encircled during net deployment. Species culled include sharks and large jacks.

# Fishing Gear Catalogue

## NET

**Gear Type:** “Moe moe” Net

**Diagram of typical gear:**



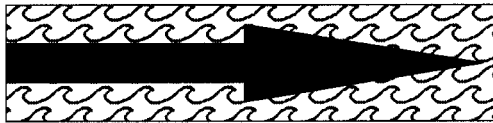
### **Deployment/retrieval:**

“Moe moe” method uses gill nets that are deployed, left unattended for a period of time, then retrieved. Nets are typically made of 12 to 20 pound monofilament. Length can range from 75 to 150 feet and average height is 7 feet. Mesh or eye size is typically 2.75 inches, but can vary depending on species targeted. Most local fishery management agencies have minimum mesh size limits for this type of net. The net is a single panel with floats on the top and a leadline on the bottom. Nets can be set on the bottom, in mid-water or on the surface. Most fishers using this type of net set on the bottom.

It is common for several segments (10-12) of moe moe net to be tied together when deployed. Most fishers target depths ranging from the shoreline to 30+ feet. To avoid gear loss and damage, fishers avoid high surge and surf areas. Nets are targeted for sandy areas adjacent to the reef or set along the reef. Gear is usually deployed from a floating platform, eg. large inner tube, dingy, or small boat. A heavy object (ie. lead, rebar, or concrete) is attached to the lead line as an anchor and a large float attached to the float line to mark one end of the net. The rest of the net is then layed out until the other end is reached to which another anchor and float is attached. The Hawaiian term “moe moe” is to sleep. This term is used for this gear because of the timing of deployment and retrieval. Nets are commonly set in the late afternoon or early evening and retrieved in the morning. Fishers check the net every 2-3 hours. Nets are also set during the day for 2-4 hour periods or set in the late afternoon and retrieved before mid-night. When retrieving the gear, it is common for a diver to swim along and untangle the leadline as the net is being pulled and loaded into an inner tube of boat. This helps minimize damage to the net.

The practice of using moe moe nets in deeper waters, from 150 to 200 feet, has recently become more common. Longer strings of net (up to 3000 feet) are deployed from vessels in these targeted depths. Like the shallow water moe moe net, it is left for a period of time and later retrieved using hydraulics.

### **Habitat Impacts:**

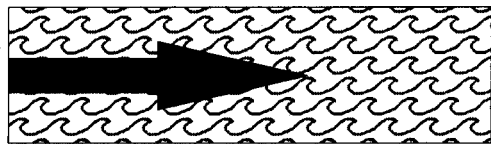


Low Med High

Recent use of large amounts of gill nets set between 10-100 m in depth to catch reef fish in state waters in the Main Hawaiian Islands may adversely impact EFH. The nets are have the potential to be highly unselective and take indiscriminate cross-sections

of the fish community. They also have a potential to damage substantial areas of coral if it is carelessly retrieved, or retrieved by power block. Under the CRE-FMP, the use of gillnets are prohibited in federal waters. Potential impacts to habitat include entanglement and breakage of corals.

### **Bycatch:**



Low Med High

Gill nets as used in the moe moe method catch wide range of reef species. Selectivity of fish size can be controlled by varying the mesh. However, in most cases, all species caught in the net are utilized.

### **Measures to mitigate potential adverse impacts to EFH**

#### *Gear prohibitions:*

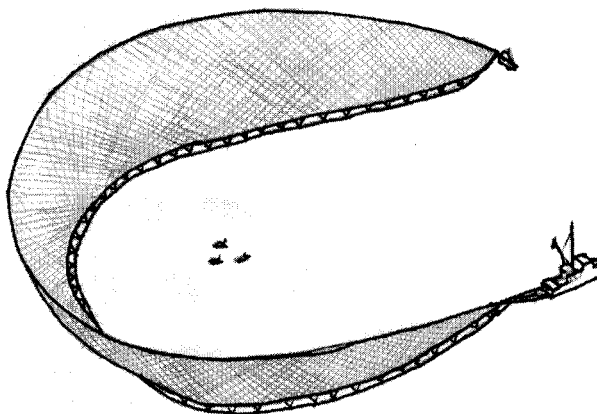
Currently, gillnet fishing is allowed by some local governments in the Western Pacific Region. Although this type of fishing is seldom used in federal waters, there is a potential for this type of fishing to expand into shallow federal waters adjacent to state waters. Under the CRE FMP, fishing gillnets will be prohibited.

# Fishing Gear Catalogue

## NET

**Gear Type:** Purse Seine

**Diagram of typical gear:**

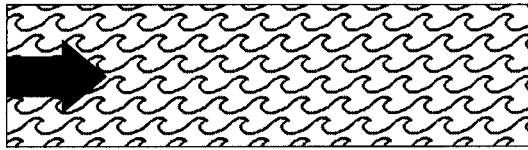


### **Deployment/retrieval:**

The purse seine technique consists of setting, pursing, hauling net, “sacking up” and brailing. After spotting a suitable school, the net is set at high speed with the help of a powerful skiff to encircle the entire school. A winch then hauls the ends of the net together and closes, or “purses”, the bottom of the net to trap the fish school by hauling in the purse cable. When pursing is complete, one end of the net is fed through the hydraulic power block which hauls in the net. The net is stacked on the deck by the crew to prepare for the next set. When most of the net is on board, the net is sacked up, which concentrates the fish next to the hull. The catch is then brailed from the net to refrigerated fish holds using a brailer net that can hold about two tons of fish per scoop. Most modern tuna purse seiners usually do not return to port until their fish holds are completely filled, which may take 3-8 week or more. Western Pacific seiners set their nets on free tuna schools sighted on the surface of the ocean during daylight hours, or before dawn on schools found associated with drifting logs or man-made rafts. Pre-dawn log sets are usually successful as the tuna are very close to the log, and setting and pursing can be completed before the fish can avoid the net. Daytime sets are often less successful, but are beginning to account for larger catches due to experience and improvements in fishing technology.



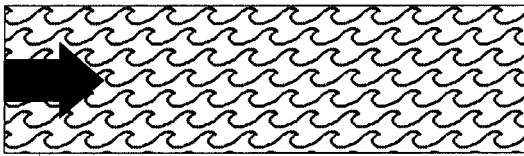
### Habitat Impacts:



Low                      Med                      High

Purse seine is a surface pelagic gear that poses minimal impacts, if any, to habitat.

### Bycatch:



Low                      Med                      High

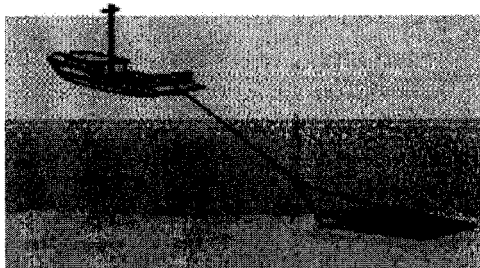
Because tunas are usually not associated with porpoises in the Western Pacific Region, seiners operating there do not have an associated porpoise bycatch. Some purse seine sets do have a large catch of non-target species, and these bycatch levels are higher when setting on schools that are associated with drifting logs

and rafts due to the attraction of many fish species to drifting debris in the open ocean. Typical purse seine bycatch includes rainbow runner, dolphinfish, wahoo, marlin, pelagic sharks, mackerel scad, oceanic trigger-fish and rudderfish. The reported bycatch from the US purse seine fleet in the western Pacific has consistently been less than 1% of the total catch.

# Fishing Gear Catalogue

## Dredge

**Gear Type:** Tangle net dredge



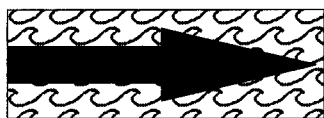
### Diagram of typical gear:

Historically, the primary method used to harvest precious corals has been the use of dredges, or tangle nets. There are only two known instances of domestic fishermen using tangle nets to attempt to harvest deepwater precious corals. During the late 1960s a small group of fishermen dredged for pink coral off of Oahu in the Makapuu Bed on a small scale using tangle nets. In 1988 a domestic fishing vessel attempted to harvest deepwater precious coral on the Hancock seamounts. The amount of coral harvested was extremely limited and of poor quality.

The basic gear design of these dredges consists of weighted tangles (a dredge) with attached netting. The weights serve to keep the dredge on the bottom as well as to dislodge the coral, and the attached nets entangle the coral.

Foreign dredge haulers used in the precious coral fishery range in size from 40 to 100 ft. Dredges are deployed with the aid of hydraulic line haulers located amidship. The dredges are raised and lowered over the side of the vessel. Once the dredges are deployed the vessel is allowed to drift positioned at right angles to the current. Japanese vessels normally deploy from 4 to 8 simultaneously. Larger vessels may use as many as sixteen dredges simultaneously. Fishing operations are typically conducted around the clock with crews rotating. The same grounds are often dredged.

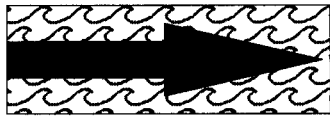
### Habitat Impacts:



Low Med High

Tangle nets may be ecologically destructive, as other species and habitat may be disturbed, and it may be wasteful, as some coral dislodged from the bottom may not be recovered.

### **Bycatch:**



Low

Med

High

This method of harvesting precious corals is non-selective; the dredge simply knocks down all corals in its path. This gear cannot discriminate between types, size, quality or characteristics of living or dead corals. Based on simulated

harvests studies conducted in shallow water, it is estimated that dredges only recover 40% of the total amount of corals initially knocked down. Because an area is often dredged several times the overall recovery rate of dislodged coral is probably significantly greater.

### **Existing measure to mitigate potential adverse impacts to EFH**

#### ***Gear restrictions:***

In the main Hawaiian Islands, the use of non-selective gear is prohibited to harvest precious corals.

#### ***Closed Areas:***

The harvest of precious coral from the WestPac Refugia Bed, located in the NWHI, is prohibited.

#### ***Harvest Limitation Program***

Quotas have been established for pink, gold, and bamboo corals for Makapuu Bed and the conditional beds in the NWHI.

### **Proposed measures to mitigate potential adverse impacts to EFH**

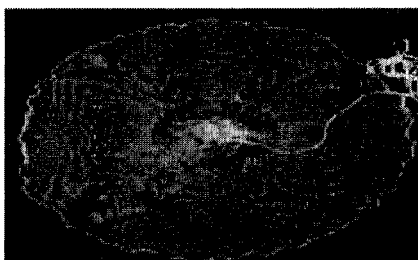
Under a framework adjustment to the Fishery Management Plan for the Precious Coral Fisheries the Western Pacific Region Amendment approved by the Council and currently under review by the NMFS, only selective gear will be allowed to harvest precious corals from all permit areas.

# Fishing Gear Catalogue

## NET

**Gear Type:** Throw net

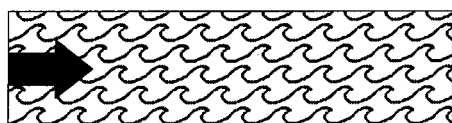
**Diagram of typical gear:**



### **Deployment/retrieval:**

Throw nets are circular with a radius that can vary from 8-12 feet. Net are weighted around the edge and are generally made of monofilament but can also be constructed of cotton, nylon, or other material. For example, in Guam traditional throw nets called “talaya” were made of pineapple leaf fibers. Throw nets can include a pocket on the outer edge of the net to trap fish. Pockets are made by layering a larger mesh net on the inside of the nets outer edge. The net is deployed by a skillful fisher who tosses the net over and around a school of fish. The fisher then enters the water to gather the open bottom of the net to trap the fish. Throwing the net so that it fully opens as it enters the ocean surface requires skill and practice. A more difficult aspect of throw net fishing is to develop the skill to approach a school of fish without notice and within a distance from which the net can be successfully deployed. Nets are generally thrown in or near the surf zone.

### **Habitat Impacts:**



Low

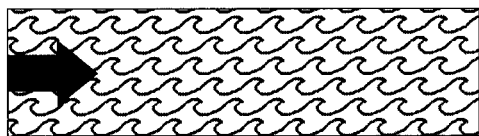
Med

High

Throw nets have a low to moderate impact on coral reef habitat. Nets can be deployed on hard, sandy or a combination of substrates that are immediately adjacent to the shoreline. Fishers generally attempt to target flat areas with minimal rock or coral outcrops to

limit the chances of fish to escape. Fishers retrieve nets by hand which serves to minimizes impacts to benthic habitat, including coral reefs.

## Bycatch:



Low

Med

High

Throw nets are generally selective due to specific targeting of species by fishers, eg. moi, kala, moana, manini, aholehole and mullet that swim in schools close to shore. However, because fishing is taking place in the surf zone, it is difficult to see all fish that are in the area where the net is to be deployed.

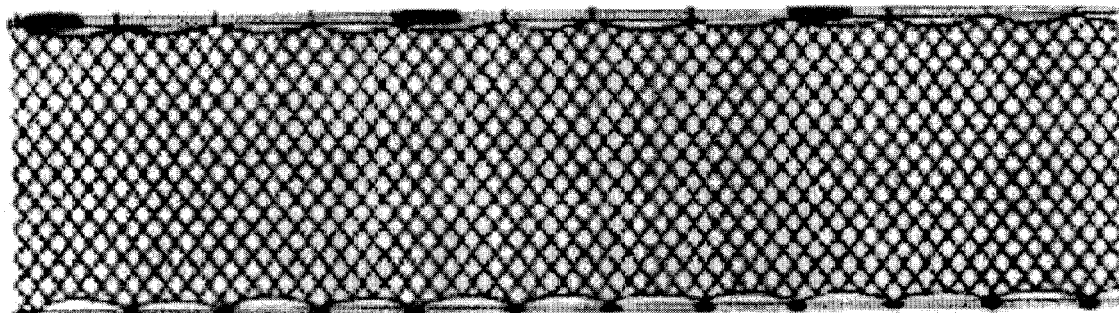
Most species that are caught in throw net fishing are retained. Fish that are undersized or undesired are generally returned alive.

# Fishing Gear Catalogue

## NET

**Gear Type:** Weke/Taape Surround Net

**Diagram of typical gear:**



### **Deployment/retrieval:**

Goat fish and snapper surround nets are constructed of nylon and range in length from 75-100 feet and are 18 feet high. The typical mesh size used in net construction is 2 inches. The net is a single panel with floats on the top and a leadline on the bottom. A bag net is constructed of nylon with 1.5 inch eyes and is used exclusively to transport fish from the surround net to the surface.

Once a school is located in calm waters with soft bottom, the fish is surrounded with sections of net deployed under water by SCUBA divers or on the surface by skiff. After the school is surrounded, several scuba divers bring the lead lines together and tie the nets together to encircle the school. The net is slowly collapsed by concentrating the fish and removing sections of net until the bag net can be attached and fish corralled into the bag net. Once fish enter the bag net, it is tied off and taken to the vessel where the fish are brailed aboard. Unlike the akule net, this net does not have to be suspended through the entire water column from surface to bottom.

### **Habitat Impacts:**



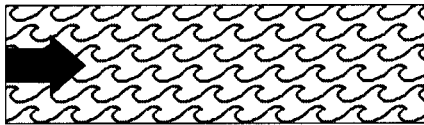
Low Med High

Surround nets for weke and taape have minimal impact on coral reef habitat. Fishing usually occurs seaward of the reef in shallow sandy areas. Fishermen actively avoid substrates with high or varied benthic relief because of the difficulty such areas present to successfully encircling and capturing the targeted school of fish. In areas of high

relief or numerous coral outcrops, the net would become entangled, damaging both the

net itself and allowing the school of fish to escape. Use of scuba divers to set and retrieve the net further minimizes potential impacts to benthic habitat, including coral reefs.

**Bycatch:**



Surround nets are relatively selective as deployed and retrieved for weke and taape. Substantial effort is made prior to deployment of the net to identify a school in a suitable area, sandy flat substrate. During net retrieval, efforts are made by scuba divers to cull out any unwanted species that may have been inadvertently encircled during net deployment. Species culled include sharks and large jacks.

**Measures to mitigate potential impacts to EFH**

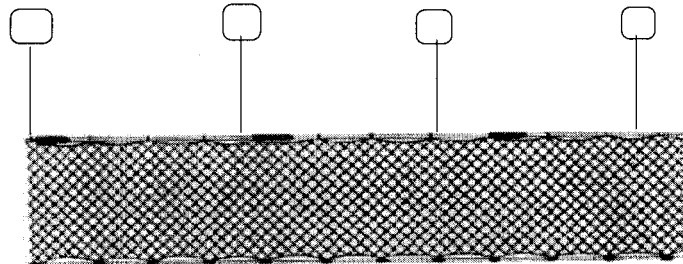
Under the CRE FMP, anyone wishing to fish with weke surround net may be required to apply for a permit with the appropriate local government agency. Anyone wishing to collect an species listed in the CRE-FMP as Potentially Harvested MUS, or anyone wishing to fish in a low-use MPA in the EEZ, must contact either the PIAO directly or will be directed to contact the PIAO by their regional marine fisheries office. If it is determined that the person(s) must complete a special permit application. The applicant must also describe the gear and target species in the special permit section application. A ruling on this gear type will be determined by the NMFS PIAO Administrator after consultation with the Council and the director of the affected state fishery management agency.

# Fishing Gear Catalogue

## NET

**Gear Type:**            **Barrier Net**

**Diagram of typical gear:**



**Deployment/retrieval:**

The vast majority of aquarium fishes collected in the Pacific region are captured through the use of barrier nets and hand nets. Pyle (1993) provides a detailed description of barrier nets and their use. The following draws heavily upon this description.

The general design of a barrier net is a rectangular section of monofilament netting, weighted along the bottom with lead or chain, and buoyed along the top with small floats. Although barrier nets vary in size from less than one meter in length to as long as 20 meters, they generally fall into one of two categories: small and large.

Small barrier nets are typically less than 5 m in length and less than 0.5 m in height. Small barrier nets are deployed by a single diver. The lead line is comprised of a chain or lead weights closely spaced. This allows the net to conformed to the contours of the bottom where it is set. Small barrier nets are set either in a v-shaped configuration or stretched out. The diver uses hand nets to drive the fish into the net.

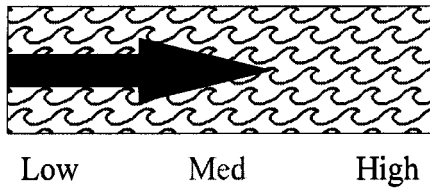
Large nets are characterized by typically being longer than 10 m in length and one meter in height. Large barrier nets usually are deployed by two or more divers. Large nets are used to target schooling fish such as the surgeonfish, tangs and wrasses.

The net is set in a v-shaped configuration. The divers then carefully drive fish into the net using hand nets. Once the fish are concentrated in the apex of the net, the divers bring the net together, completing the enclosure of the fish within the net.

Nets are deployed contingent upon the targeted species particular habitat preferences.

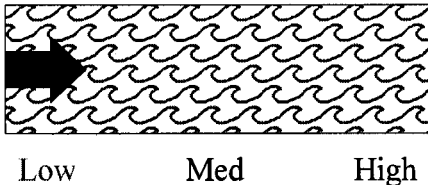


## Habitat Impacts:



Barrier nets for aquarium fish have a low to moderate impact on coral reef habitat. Nets are typically deployed on or immediately adjacent to coral reef habitat. The use of scuba divers to deploy and retrieve the net serves to minimize impacts to benthic habitat, including coral reefs.

## Bycatch



Aquarium fish collectors are highly selective when collecting coral reef and other marine organisms. Usually, a collector will target a specific species in locations where they are most abundant and attempt to capture only those which are of value. Other fish may be captured with the target species however, they are

usually released back since they have no commercial value.

## Measures to mitigate potential impacts to EFH

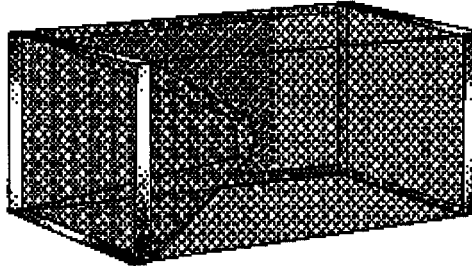
Although aquarium fish collection with barrier net will be allowed under the CRE-FMP, anyone wishing to collect aquarium fish species may be required to apply for a permit with the appropriate local government agency. Anyone wishing to collect an aquarium fish listed as a Potentially Harvested MUS, or anyone wishing to fish in a low-use MPA in the EEZ, must contact either the PIAO directly or will be directed to contact the PIAO by their regional marine fisheries office. If it is determined that the person(s) must complete a special permit application, a ruling will be determined by the NMFS PIAO Administrator after consultation with the Council and the director of the affected state fishery management agency.

# Fishing Gear Catalog

## TRAP

**Gear Type:** Crab Trap

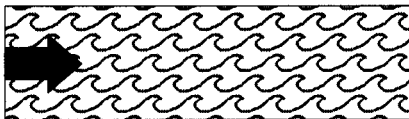
**Diagram of typical gear:**



### **Deployment/retrieval:**

Traps are deployed individually or on a string set up to 200 feet apart. Floaters are used to mark individual trap locations or the ends of trap strings. Primary species targeted is white crab which live in sandy areas. Depth range for deployment range from 40 to 300 feet. Crab traps are constructed with similar material as used for fish traps but often have heavier frames. A variety of trap designs are used by fishermen. Traps are generally smaller than fish traps and can have multiple compartments. The trap entrance is modeled after a ramp allowing crabs to crawl up the ramp and fall into the trap while prohibiting escape. Soak time can vary between 1 to 3 days and depends on location, season, density of fish and other personal variables. The average soak time is one week. Retrieval is done by hand or with hydraulics. Bait (ahi head, mackerel) is always used in traps for white crabs.

### **Habitat Impacts:**



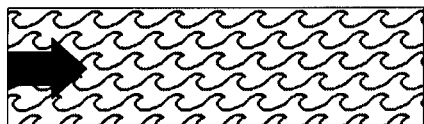
Low

Med

High

Portable traps for white crabs pose minimal potential habitat damage due to selective placement in areas with extensive sandy habitat. Coral and other hard substrate are highly avoided.

Because of the low number of traps used and floater lines, fishermen rarely lose traps. Trap door hinges are secured with low quality wire that decompose quickly in the marine environment. This wire will completely corrode within as short of period of time as a month, leaving the trap door open. The galvanized chicken wire used to construct traps also rapidly corrodes in the marine environment. Some fishermen attach zinc to extend the life of traps.

**Bycatch:**

Low

Med

High

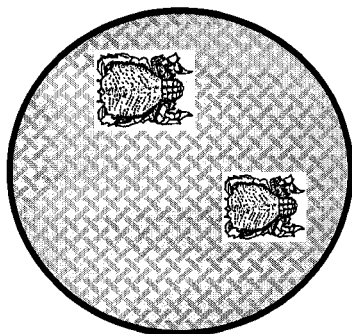
Ghost fishing due to lost traps is rare. Crab traps are species selective based on targeted habitat. Traps are placed on sandy substrate.

# Fishing Gear Catalogue

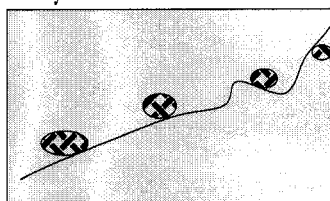
# NET

**Gear Type:** Kona Crab Net

**Diagram of typical gear:**



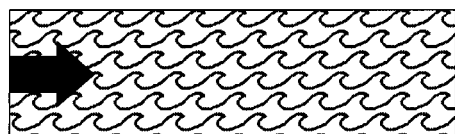
String of kona crab nets deployed on sandy bottom



## Deployment/retrieval:

Nets are deployed on a string with 25 traps per string. Three strings are often used simultaneously. Floaters are attached to mark and retrieve individual strings. Each net consists of a heavy gauge metal hoop or rectangle with monofilament netting stretched tightly across to entangle the crab's legs as they approach bait which is placed in the center. The primary species targeted is kona crab which live exclusively in sandy areas. Depth range for deployment range from 40 to 300 feet. Soak time for each string is short varying from 30 minutes to 1 hour. Strings are retrieved by hand. Kona crab typically do not enter the net during the night therefore fishing is exclusively conducted during the day.

## Habitat Impacts:

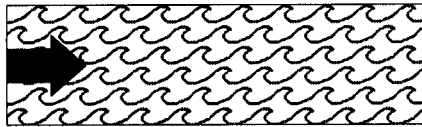


Low Med High

Kona crab nets have minimal habitat impacts due to selective placement in areas with exclusive sand substrate. Coral and other hard substrate are actively avoided. Ghost fishing due to lost strings or traps are rare. Fishermen rarely lose traps due to the low number used. Lost nets can continue to tangle crabs

while bait is still present.

**Bycatch:**



Low

Med

High

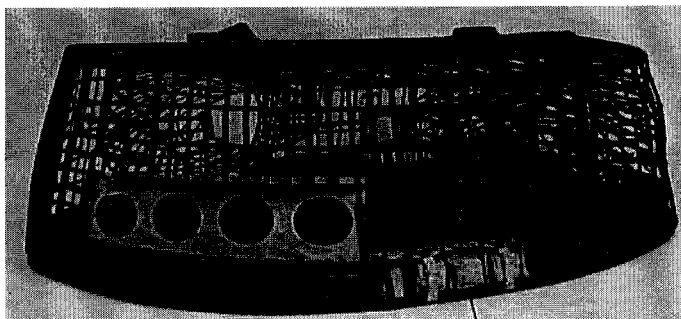
Kona crab nets are highly selective and rarely take other species.

# Fishing Gear Catalogue

## TRAP

**Gear Type:** Lobster Trap

**Diagram of typical gear:**



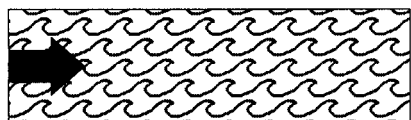
### **Deployment/retrieval:**

The commercial lobster fishery in the NWHI is a trap fishery. The principal species targeted by this fishery is the spiny lobster (*Panulirus marginatus*) and the common slipper lobster (*Scyllarides squammosus*).

All vessels participating in the NWHI lobster fishery use traps manufactured by Fathoms Plus. The trap is dome-shaped and molded from black polyethylene. The trap dimensions are approximately 2.5' x 3.2' x 1'. To ensure traps deploy upright on the bottom, lead weights are secured inside the trap. Each trap has two entrance cones located on opposite sides of the traps. The traps also have two escape vents that allow for the escape of undersized lobsters and other incidental catch such as octopus.

Traps are set in strings of several hundred at depths between 10 to 35 fathoms. The traps are baited with chopped mackerel. Vessels typically set about 800 hundred traps per day.

### **Habitat Impacts:**



Low Med High

Recently, the NMFS NWHI Observer logs and follow-up interviews with observers indicate that both pieces of live coral and entire coral heads are caught in some lobster traps and ground line and landed onboard the lobster vessel. One observer noted that "small broken pieces of coral were frequently (as many as one piece per five traps) wedged in the holes of the traps. Numerous softball-sized and a few basketball-sized whole coral heads came up stuck to the mainline." Typically the coral landed on a fishing vessel is thrown overboard, although there have been reports of pieces kept in live tanks.

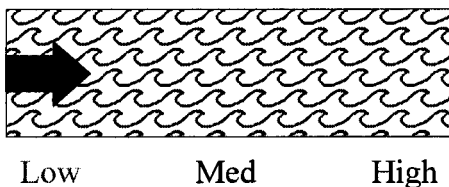
In 1998 the Council, based on the NMFS recommendation, instituted a bank specific quota for the NWHI lobster fishery. This new management regime established quotas for the primary lobster fishing grounds, Maro, Necker and Gardner and one for all other banks. The effect of this action was that lobster vessels were forced to begin exploratory fishing at banks traditionally not fished. Anecdotal reports indicate that the increased observation of coral caught in traps may be due to this exploratory fishing on unfamiliar grounds. Further, members of the Council's Crustacean Plan Team and Advisory Panel report that the problem may have been exacerbated by the inexperience of one vessel's captain.

Typically traps are set in areas of relatively low structural relief, away from coral reef habitat. If traps are set too close to coral reef and other high relief habitats, lobsters cannot be enticed to enter the traps.

The impact of lobster trapping on coral reef habitat is difficult to estimate. Only a portion of the damaged coral reaches the vessel to be seen by observers. Further, the fate of the damaged coral is unknown. Some of the damaged coral may continue growing while others may be covered in sand or swept off the banks. The damage may vary from bank to bank. Trapping at atolls where lobster habitat is limited and coral reef density high may result in more coral damage than islands with large flat algal or sand bank areas.

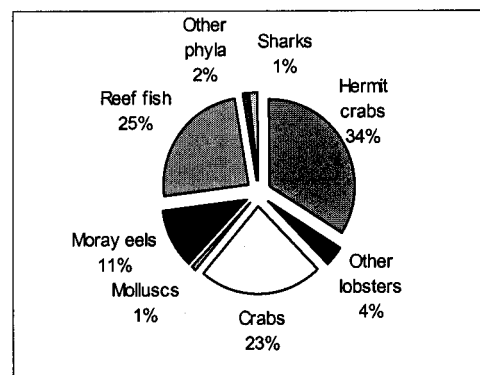
Research is needed to determine the impact of lobster trapping on coral reef habitat. This research may include both expanded observer documentation of coral brought up during trapping and research surveys of coral beds located in areas with and without trapping.

### Bycatch:



Current gear restrictions mandate that lobster traps have two entrance cones located on opposite sides of the traps. The traps must also have two

escape vents, comprised of four circular holes at least 2 ½ inches in diameter, that allow for the escape of undersized lobsters and other incidental catch such as octopus. This gear restriction has resulted in significant reduction in the incidental take of non-target species.



Because lobster fisheries in Guam, American Samoa, and NMI depend on spearing lobsters or collection by hand, both of which are highly selective methods, the amount of bycatch is likely to be negligible.

Polovina (1993) reports that an estimated 2000 traps are lost annually in the NWHI. Parrish and Kazama (1992) found that while lobsters may enter these traps they were also able to exit, and there was no observed mortality associated as with ghost fishing. These researchers concluded that lobsters utilized the traps as shelter.

### **Existing measure to mitigate potential adverse impacts to EFH**

#### *Gear restrictions:*

Lobsters may only be taken by lobster traps or by hand. The use of nets, chemicals, explosives, hook or spears is prohibited.

#### *Closed Areas:*

- 1) All lobster fishing is prohibited within 20 nm of Laysan Island.
- 2) Within the EEZ shallower than 10 fathoms.

#### *Closed Seasons:*

Lobster fishing is prohibited in the NWHI between January and June.

Lobster fishing is prohibited in the EEZ around the MHI during the months of May, June, July and August.

#### *Harvest Limitation Program*

The NWHI lobster fishery is a quota based fishery. This serves in effect to limit the total amount of fishing effort that may occur and thus limits the amount of potential adverse impacts that may result from lobster traps to EFH. The NMFS annually sets a harvest guideline, expressed as quota of the total number of lobsters that may be taken in the NWHI. Because the harvest quota is bank specific it further limits the potential adverse impacts to EFH that may result from lobster traps..

#### *Other Measures:*

Limited entry fishery (maximum of 15 permits may be valid at any one time).

Traps may not be left unattended in the water except in the event of an emergency

Vessels may not maintain more than 1200 traps on board, with no more than 1100 assembled at any one time.



## **Proposed measures to mitigate potential adverse impacts to EFH**

### *Closed Areas:*

Under proposed regulations, lobster fishing will be prohibited at French Frigate Shoals to a depth of 50 fm and at Midway to a depth of 50 fm.

### *References:*

Parrish, F.P., and T.K. Kazama. (1992) Evaluation of ghost fishing in the Hawaiian lobster fishery. Fishery Bulletin. 90: 720-725.

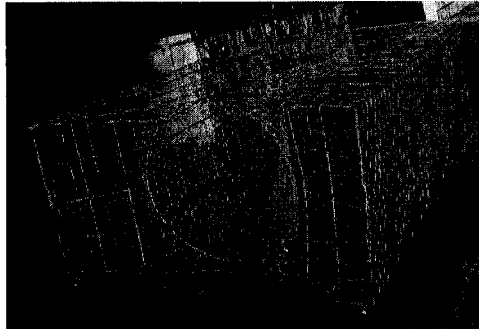
Polovina, J. (1993) The lobster and shrimp fisheries in Hawaii. Marine Fisheries Review. 55(2): 28-33.

# Fishing Gear Catalogue

## TRAP

**Gear Type:**            **Portable Fish Trap: Shallow to medium depth deployment (20-100 feet)**

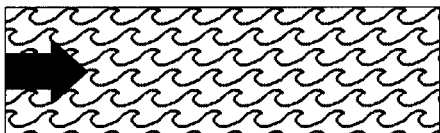
**Diagram of typical gear**



### Deployment/Retrieval

Traps are set individually by divers using SCUBA. A series of traps can range from 8 to 18 traps. Range of deployment is from 20 to 110 feet. Shallow set traps can be damaged from surge and are more easily tampered with. Fish traps are generally constructed of concrete wire for the trap frame which is covered with a finer mesh chicken wire. Typical trap dimensions are 2.5 feet high by 6 feet long by 4 feet wide. Soak time can vary between 4 to 14 days and depends on location, season, density of fish, and other personal variables. The average soak time is one week. Bait is rarely used in the shallow to mid-depth traps. Fishermen note that bait may increase the number of fish that enter the trap, but also draws undesirable species such as eels and sharks which can damage catch and increase risks to divers. Trap retrieval is assisted by flotation devices. The retrieval process is as follows: landmarks or GPS is used to locate trap; a new trap is dropped from a vessel behind the existing trap, existing trap is stood on end, air bag is attached, the bag is inflated and the trap is lifted to the surface.

### Habitat Impacts:



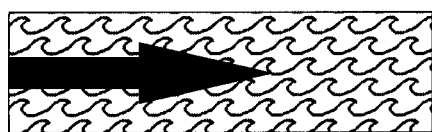
Low            Med            High

Portable fish traps as used in the Western Pacific Region in shallow to mid water depths pose minimal potential habitat damage due to hand placement and retrieval. Trap placement is critical to produce successful catch. Traps are strategically hand placed near fish houses or koa which typically include areas

with high relief ledges or reef edges. Fish enter and are also able to exit these traps making mortality associated with lost traps or ghost fishing minimal. Traps are often utilized as shelter or habitat. In some areas in the region, fishermen purposely place rocks

and coral rubble on and around traps to entice fish to use it as habitat. Because of the low number of traps used, fishermen rarely lose traps. Fishermen note that the largest factor affecting trap loss is due to theft by humans. Trap door hinges are secured with low quality wire that decompose quickly in the marine environment. In general, chicken wire used to construct traps are also highly corrosive. Some fishermen attach zinc to extend the life of traps.

### **Bycatch:**



Overall, fish traps are relatively unselective. Selectivity is increased through trap location and construction. Fish size is controlled by wire mesh size, varying funnel entrance size, and inclusion of vent holes. Small round holes in the corners allow small fish and eels to escape. Using smaller funnel entrances prohibits large jacks from entering and damaging traps. Target species generally include jacks, surgeon fishes, goat fishes, snappers, groupers, etc. Fish traps occasionally catch octopus, lobsters, crabs, and other crustaceans. Discards include aquarium and undersized fish including butterfly, damsels, etc. Fishermen estimate that 90% of discards survive.

### **Measures to mitigate potential impacts to EFH**

Anyone wishing to fish in the low-use MPAs will be required to complete a special permit subject to approval by the NMFS PIAO Administrator after consultation with the Council. Reporting is required through the special permit process and is subject to the following requirements.

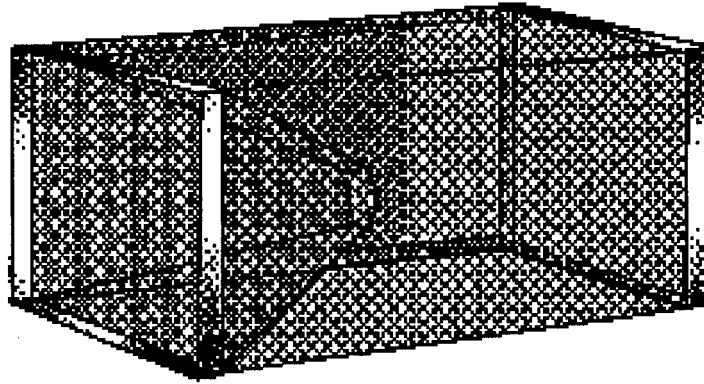
1. Report catch, effort and discards by species, location, time and other factors as specified by the Council.
2. Report protected species interactions
3. Report on any lost gear or damage to coral reef
4. Complete daily log sheets within 24 hours after completion of the fishing day
5. Submit reports within 30 days of returning to port

# Fishing Gear Catalogue

## TRAP

**Gear Type:** Portable Fish Trap: deep water deployment (100-300 feet)

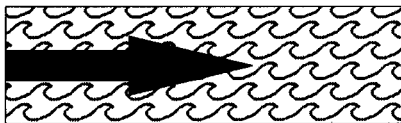
**Diagram of typical gear:**



### **Deployment/retrieval:**

Traps are deployed individually with up to 30 traps used in a series. Floaters are used to mark trap locations. Fish traps are generally constructed of concrete wire for the trap frame which is covered with a finer mesh chicken wire. Deepwater traps vary in size but are generally slightly larger than shallow to mid-depth traps. Soak time can vary between 4 to 14 days and depends on location, season, density of fish and other personal variables. The average soak time is one week. Traps are hauled using hydraulic lifts.

### **Habitat Impacts:**

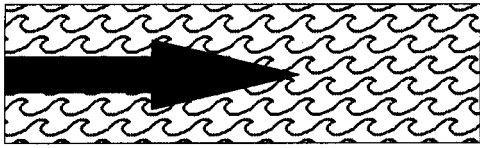


Portable fish traps as used in the Western Pacific Region in deep water depths pose only a moderate potential to damage habitat due to the selective independent placement and retrieval methods used. Trap placement is critical to produce successful catch. Large schools or specific species (weke ula, kumu and taape) are generally scouted with fish finders and targeted. Species include weke ula, moana kale, papio, kumu, and uku. Preferred substrate include hard flat areas mixed with sand, ledges, etc. Bait (ahi head, mackerel) is sometimes used in deep water traps.

Fish enter and are also able to exit these traps making mortality associated with lost traps or ghost fishing minimal. Traps are often utilized as shelter or habitat by reef species. Because of the low number of traps used and floater lines, fishermen rarely lose traps. Trap door hinges are secured with low quality wire that decompose quickly in the marine

environment. In general, chicken wire used to construct traps are also highly corrosive. Some fishermen attach zinc to extend the life of traps.

### **Bycatch:**



Overall, fish traps are relatively unselective. Selectivity is increased through trap location and construction. Fish size is controlled by wire mesh size, varying funnel entrance size, and inclusion of vent holes. Small round holes in the corners allow small fish and eels to escape. Using smaller funnel entrances prohibits large jacks from entering and damaging traps. Target species generally include jacks, surgeon fishes, goat fishes, snappers, groupers, etc. Fish traps occasionally catch octopus, lobsters, crabs, and other crustaceans. Discards include aquarium and undersized fish including butterfly, damsels, etc. Fishermen estimate that 90% of discards survive.

### **Measures to mitigate potential impacts to EFH**

Anyone wishing to fish in the low-use MPAs will be required to complete a special permit subject to approval by the NMFS PIAO Administrator after consultation with the Council. Reporting is required through the special permit process and is subject to the following requirements.

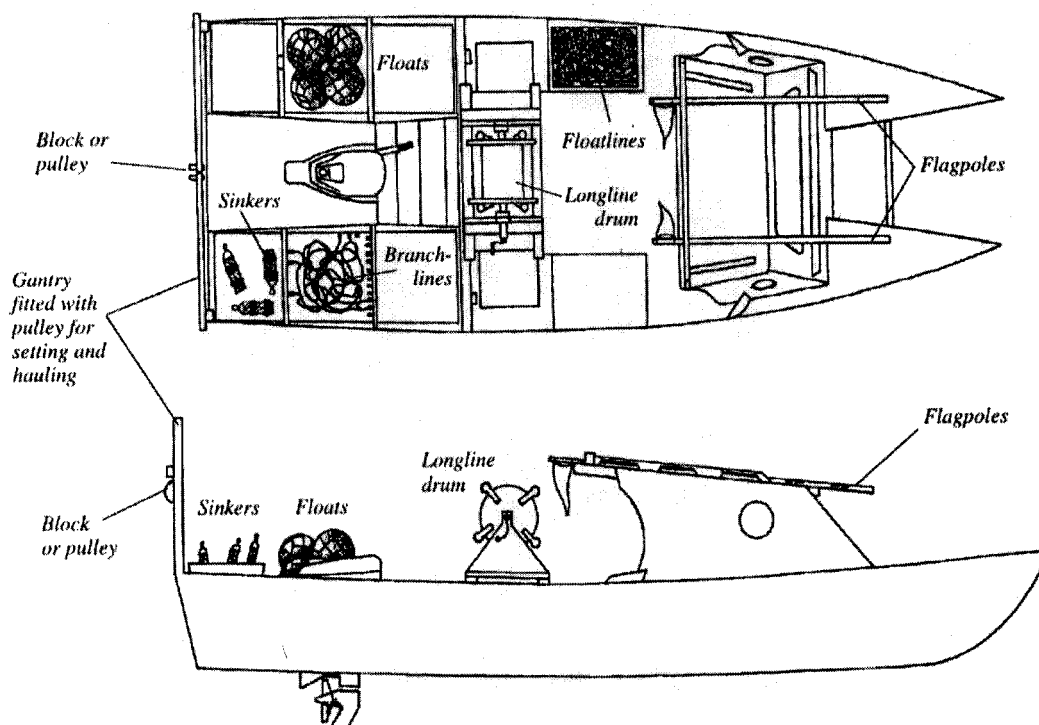
1. Report catch, effort and discards by species, location, time and other factors as specified by the Council.
2. Report protected species interactions.
3. Report on any lost gear or damage to coral reef.
4. Complete daily log sheets within 24 hours after completion of the fishing day.
5. Submit reports within 30 days of returning to port.

# Fishing Gear Catalogue

# Hook and Line

**Gear Type:** Pelagic Longline/*Alia*

**Diagram of typical gear:**



The advent of outboard motors in American Samoa in the 1950s and 1960s meant that the traditional fishing methods declined in favor of the use of motorized dinghies and skiffs for trolling and handlining. The development of offshore artisanal fisheries began in earnest during the early 1980s. It was at this time that the FAO-designed *alia* catamaran was introduced into the islands.

The extensive use of longline gear by the artisanal fleet in American Samoa is a recent phenomenon, with longline catches rising from zero prior to 1994 to almost 800,000 lbs in 1997. The stimulus for fishermen, who generally used only troll gear or handlines, to shift to longline gear was the fishing success experienced by small longline vessels in Western Samoa. The artisanal longline fleet in American Samoa presently consists mainly of 28-32 ft *alia* catamarans, although at least several larger (39 ft) *alia* have been locally constructed and outfitted for longline fishing.

The vessels deploy a short monofilament longline with 200-300 hooks from a hand powered reel through a block or pulley located at the stern. The block or pulley is rigged above the transom of the boat so that the line can be set and hauled over the stern of the vessel. The longlines harvest mainly albacore tuna, which are sold to the local tuna canneries. The use of longline gear requires the acquisition of a federal permit from the NMFS Pacific Islands Area Office, but there are no restrictions on the number of permits issued. To date, 40 permits have been issued, although only about 17 vessels are active on a regular basis.

### **Habitat Impacts:**



Low

Med

High

Pelagic longline gear does not adversely affect essential fish habitat. All gear is deployed in the water column and does not interact with bottom substrate. The habitat of pelagic species targeted by longline gear is the open-ocean water column.

### **Bycatch:**



Low

Med

High

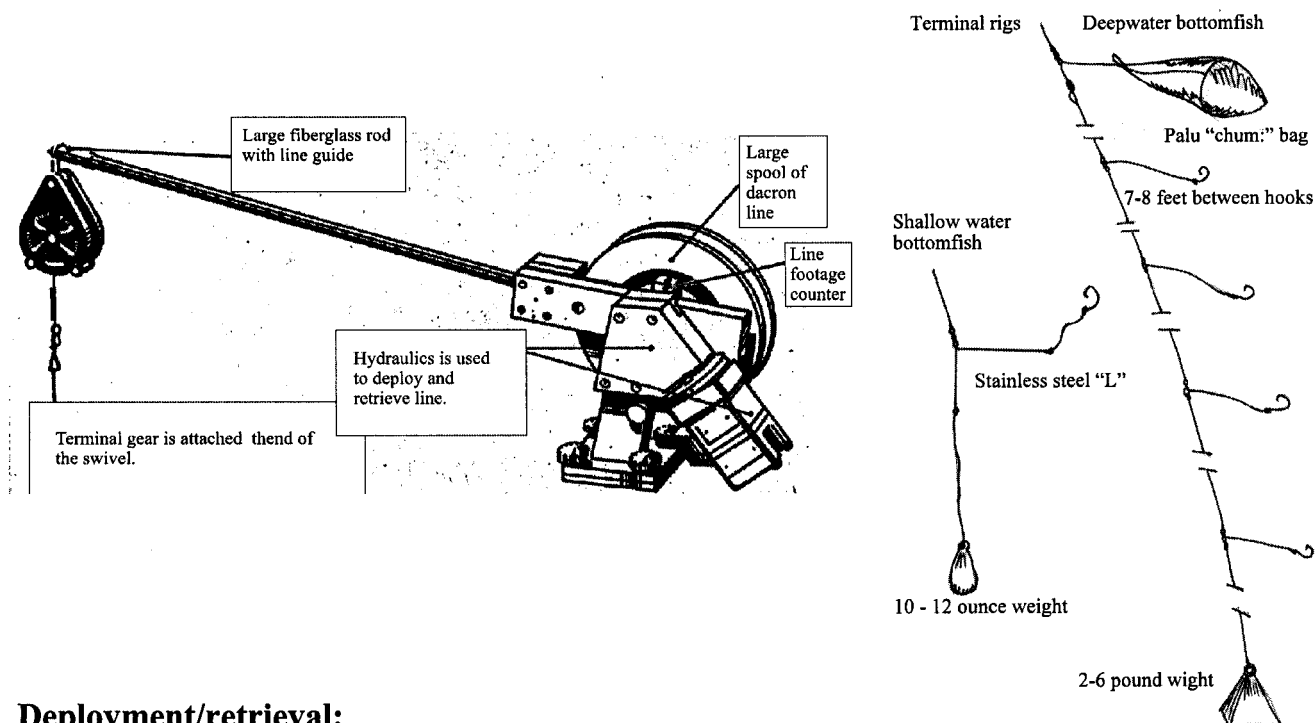
Pelagic longline gear is a relatively selective gear. In addition to tuna or swordfish, usual longline catch includes dolphinfish, wahoo, barracuda, moonfish, pomfrets and sharks.

# Fishing Gear Catalogue

## HOOK & LINE

**Gear Type: Bottomfish Handline**

**Diagram of typical gear:**



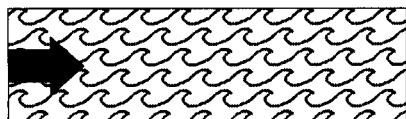
### Deployment/retrieval:

The domestic bottomfish fishery for deep-sea snappers and groupers (onaga, ehū, opakapaka and hapuupuu) relies primarily on hydraulic or electric handline gear as diagramed above. The standard deep-sea bottom fishing rig consists of a 130 lb test mainline, to which a terminal rig is attached. The terminal rig consists of a drop line, hook lines three feet in length (40-60 lb hard monofilament), circle hooks and a lead weight. Four to 12 hooks are spaced at 7-8 foot intervals along the main line. A chum bag is attached just above the last hook and filled with finely chopped fish. Each hook is baited with fish or squid. The gear is lowered to the bottom. Depending on species targeted, the gear is fished at depths ranging from 50-150 fathoms. Once at the bottom, the gear is jerked sharply to release the chum bag. The gear is then raised to fish approximately 1 fathom off the bottom. The mainline is hauled either by hand, hydraulic gurdy or electric reel. A hand operated wooden reel is commonly used in American Samoa. Vessels drift or anchor during gear deployment depending on weather conditions, ocean currents, species targeted, and other variables.



Shallow water bottom fishing is conducted in depths from 30-200 feet. Two primary methods include use of rod and reel or handline. Rod and reel is commonly used by recreational and charter fishers. Gear includes use of a stiff rod, spinner reel, 30 pound test line, single baited hook, and sinker. Handline fishers typically use 100 pound test monofilament spun on wooden spools. Terminal gear includes a stainless steel "L" spreader, single baited hook and 10-12 ounce sinker. Fishing is primarily conducted while drifting.

### Habitat Impacts:

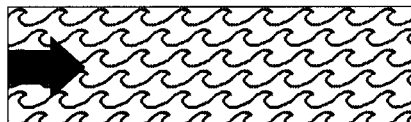


Low Med High

Bottomfish gear has very limited impacts on habitat. Habitat damage may occur from deployment of anchors during deep water fishing activities. However, damage is highly localized as the total targeted fishing habitat is limited to 100 fathoms contours areas with high relief.

Anchoring during fishing operations is generally conducted at depths from 40-60 fathoms, with depths ranging from 30 to 175 fathoms. Reef building corals are generally not found below 50 fathoms, the lower extent of light attenuation. It is estimated that suitable bottomfish habitat where vessel anchoring might occur represents approximately 1% of the total bank habitat. Shallow water bottomfish activities are conducted while drifting, therefore minimizing the potential for anchor damage.

### Bycatch:



Low Med High

Being a hook and line rig, this gear is relatively selective, with the ability to successfully target particular species groups dependant upon the skill of the fisher.

Experienced vessel crews have the ability to catch the desired species with very little bycatch. Gear is deployed at specific depths and in areas of certain habitat

characteristics, e.g. high relief. Fishers target these areas using sophisticated electronic equipment such as depth/fish finders and global positioning devices. It is, however, impossible to completely avoid non-target species.

Logbook data and research programs conducted by the State of Hawaii and the NMFS indicate that bycatch accounts for approximately 8-19% of the total catch in bottomfish fisheries in the Hawaiian archipelago. Sharks, oilfish, snake mackerel, pufferfish, and moray eels are the most numerous discard species; they are not kept by vessels because of their unpalatability. With the recent increase in market demand for shark fins, more sharks are now "finned" before they are discarded. Some carangids (large jacks and amberjacks) are also discarded because of concerns of ciguatera poisoning. The major

discard species in the NWHI bottomfish fishery are given in the table below. It should be noted that a large percentage of the snappers and the grouper listed below are included as bycatch because of damage from sharks.

Table. NMFS logbook estimates of discards in the NWHI deepwater bottomfish fishery, 1997.

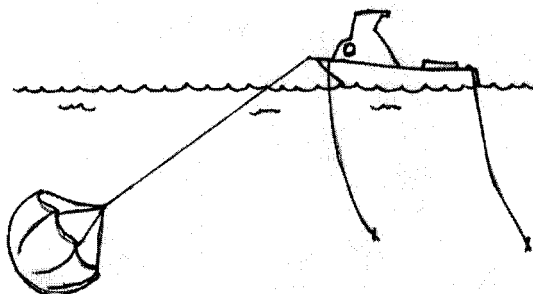
Scientific Name	Common Name	No. Discarded
<i>Seriola dumerilli</i>	amberjack	2,120
<i>Caranx ignobilis</i>	black trevally	1,298
<i>P. filamentosus</i>	pink snapper	215
Charcacinidae	misc. sharks	166
<i>Epinephelus quernus</i>	seabass	114
<i>Etelis carbunculus</i>	red snapper	98
<i>P. zonatus</i>	yellowband snapper	98
<i>Aprion virescens</i>	jobfish	87
<i>Pristipomoides auricilla</i>	yellowtail snapper	19
Carangidae	misc. jacks	7
<i>Galeocerdo cuvier</i>	Tiger shark	5
<i>Aphareus rutilans</i>	red snapper	2

# Fishing Gear Catalogue

## Hook and Line

**Gear Type:** Pelagic Handline

**Diagram of typical gear:**



### **Deployment/retrieval:**

Handline fishing is an ancient technique used to catch tunas with simple gear and small boats. This technique was developed by Polynesians and Micronesians living on atolls and small islands to catch yellowfin and bigeye tuna. This fishery continues in isolated areas of the Pacific, and is the basis of an important commercial fishery in Hawaii.

The Hawaii handline fishery has nearshore and offshore components. The nearshore fishery operates within a few miles of shore, and targets large yellowfin and bigeye tunas. The full and part-time commercial boats engaged in the nearshore fishery are about (25-35 ft long, and typically operate with a captain and sometimes one crew. In comparison, the mostly full-time commercial offshore handline boats are about 35-56 ft) long, and typically operate with a captain and one or two crew. The offshore fishery targets juvenile bigeye and yellowfin tuna around seamounts and weather buoys that are 50-320 km (35-200 nm) from shore.

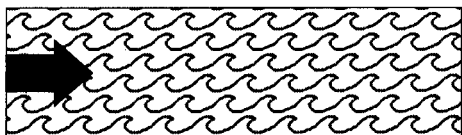
When the fishing area is reached, a parachute sea anchor is deployed to slow the vessel's drift while the fishermen engage in either night ("*ika-shibi*" or squid-tuna) or day ("*palu-ahi*" or chum-tuna) fishing.

In the nighttime *ika-shibi* fishery, three to four handlines are set, each consisting of a long nylon rope connected to dacron or polypropylene mainline, which is attached to a monofilament nylon leader. The hook is usually baited with mackerel scad, and is lowered with the help of a lead weight. To attract baitfish and tuna to the area, a low wattage light bulb is placed in the water, and the surface is chummed with chopped squid

and/or whole or chopped anchovies. The daytime *palu-ahi* technique adds a weighted, retrievable bag stuffed with chum that is released at a depth of (400-460 ft) to attract tunas to the baited hook. When a fish is hooked, it is manually hauled in, gaffed and then killed by a hit to the head with a bullet or wooden bat. Once the fish is on board, fishermen may bleed it and remove its head and viscera, and then place the fish in a mixture of ice and saltwater. These handling methods help to quickly cool the flesh so it will not become “burnt” (discolored and/or soft).

A nearshore handline trip usually lasts 1-2 days, while an offshore trip may last 1-5 days. Individual fish caught in the nearshore fishery typically weigh 18-90 kg (40-200 lb), and a good trip might land 130-180 kg (300-400 lb). Individual fish caught in the offshore fishery range from 4-32 kg (10-70 lb), and a good offshore trip might land 1,300-1,800 kg (3,000-4,000 lb). Much of the handline fish is sold directly to grocery stores and restaurants or peddled along the roadside, and some is shipped fresh by brokers to the various islands.

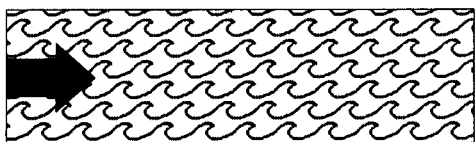
#### **Habitat Impacts:**



Low                      Med                      High

Pelagic handling gear has minimal habitat impacts. All gear is deployed in the water column without impacting the bottom substrate.

#### **Bycatch:**



Low                      Med                      High

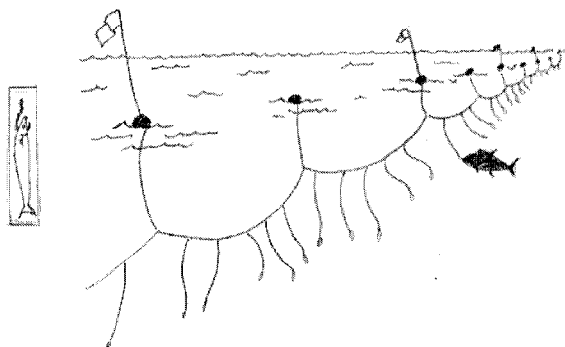
Handline bycatch is mostly utilized, and includes swordfish, dolphinfish and wahoo. Sharks are also caught, but usually not kept. The handline fishery is active year-round, and many handliners also anticipate in the bottomfish and troll fisheries.

# Fishing Gear Catalogue

## Hook and Line

**Gear Type:** Pelagic Longline

**Diagram of typical gear:**



### **Deployment/retrieval:**

Modern tuna longlining evolved from techniques developed in Japan several hundred years ago as a relatively simple method to harvest large yellowfin tuna and albacore. This technique is preferred for harvesting large tunas for *sashimi* markets, and swordfish. Longline gear consists of a mainline that is set horizontally near the surface, to which branch lines ('gangions') are clipped at regular intervals, each with a single baited hook.

The mainline is typically 30-100 km (18-60 nm) long, with 400-2,000 baited hooks set each day (with an average of 800 in the Hawaiian fishery). The branch lines are typically 35-50 ft long. When targeting swordfish, buoys are hooked to the mainline at about 500 m (1,650 ft) intervals, with 30-70 ft of line to keep the mainline below the surface. Radar reflectors and radio beacons are used to keep track of the line. To target deeper-swimming bigeye tuna, line shooters are sometimes used to put slack into the mainline to make it sink deeper. These deeper sets use no light sticks and often have 6-7 branch lines between the floats, as compared to 2-3 gangions used when targeting swordfish.

Longliners set and retrieve their gear once a day, with the time of setting and hauling determined by the fish being targeted and prevailing fishing conditions. The mainline is set while the vessel steams across the prevailing current at about 15 km/hr (8 knots, kt) while the crew snaps baited branch lines, typically 60-90 ft long, to the mainline about every 150 feet. The hooks are typically baited with sardine, scad, squid or saury, and a

buoy is attached to the mainline about every 12 hooks. To set the mainline deeper where valuable bigeye tuna are found, more branch lines are attached between buoys, longer buoy lines are used, and a line shooter releases more of the mainline to create slack during setting. Marker flags, lighted buoys and radio beacons are attached at regular intervals to mark the line.

Once set, the vessel may drift nearby or steam slowly along the line looking for bobbing floats that signal the presence of a struggling fish, in which case that section of the line is hauled and hooks are re-baited. Otherwise, the line may be left to soak until noon, when the hauling process begins. Retrieval of the gear may take as long as 12 hours. When hauling the line, the vessel must be kept constantly underway at 3-6 km/hr (2-3 kt), with the ship at a 150 to 450 angle to the mainline, as the line is too heavy to haul from a stationary vessel. Retrieval of the line is assisted by a hydraulic line hauler mounted near the foredeck rail. As the mainline is retrieved, the crew removes branch lines, buoy lines, lights and radio buoys, which are readied for the next day's set. After the hauling is complete, damaged sections of the mainline are replaced, and all gear and bait are made ready for the next morning's set.

Longlining for swordfish in the North Pacific is a relatively new fishery for the U.S., and the introduction of chemical light sticks in the late 1970s revolutionized the industry. Lights are attached by rubber bands or line clips to the branch lines about 2 in (6 ft) above the hook. The light sticks produce a chemical luminescence for up to 24 hr. The lights are available in a variety of colors and are thought to attract either the bait upon which swordfish prey, or the swordfish themselves. The light sticks are positively buoyant and of a shape and size that, if inadvertently lost from the branch line or discarded improperly, could create problems if ingested by marine mammals, seabirds or marine turtles.

Due to the potential interaction with marine turtles, shallow-set longline fishing is now prohibited in the entire North Pacific Ocean.

### **Habitat Impacts:**



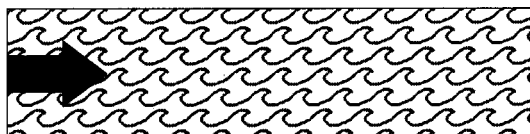
Low

Med

High

Pelagic longline gear does not adversely affect essential fish habitat. All gear is deployed in the water column and does not interact with bottom substrate. The habitat of pelagic species targeted by longline gear is the open-ocean water column.

## Bycatch:



Low

Med

High

Pelagic longline gear is a relatively selective gear. In addition to tuna or swordfish, usual longline catch includes dolphinfish, wahoo, barracuda, moonfish, pomfrets and sharks, nearly all of which are kept and utilized.

Typically, however, only the fins of sharks are kept and dried for shark fin soup, and usually only mako and thresher shark carcasses are landed whole. The incidental hooking of sea turtles is a rare event and there has never been an interaction with the endangered short-tailed albatros (*Phoebastria albatrus*).

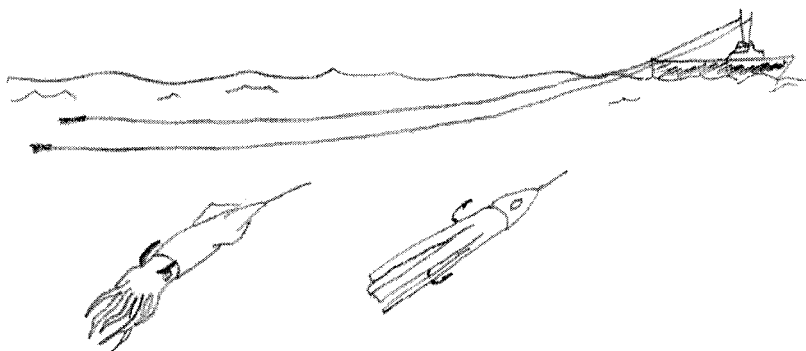
Only a small percentage of the hooks on a given longline catch fish; typical catch rates for 1,000 hooks set from an Asian longliner may average 10-13 albacore, and 5-15 yellowfin or bigeye tuna, and a few billfish. Albacore taken on longline gear are mostly large, mature fish over four years old, weighing over 16 kg (35 lb). Yellowfin and bigeye tuna are also larger, older fish ranging to well over 90 kg (200 lb). The large number of hooks set, long trips, lower operating expenses (compared to purse seine vessels), and high value of the catch maintain the economic viability of the fishery.

# Fishing Gear Catalogue

## HOOK & LINE

**Gear Type:** Trolling

**Diagram of typical gear:**



### **Deployment/retrieval:**

Trolling refers to the towing of artificial lures or natural baits near the surface from a moving boat ("trolling" and "trawling" are sometimes confused, but trawling refers to a vessel towing a net along the bottom or in the water column to harvest fish, shrimp or shellfish). Most areas of the Pacific have a relatively large number of small recreational and commercial trolling vessels, and trolling from chartered boats is popular in some areas. In addition, a fleet of high seas albacore trollers is also active throughout the Pacific.

Trolling is the most popular pelagic fishing method in the region and includes full and part-time commercial (including charter boats) and recreational/subsistence participants. The pelagic troll fishery targets blue marlin, yellowfin tuna, dolphinfish, wahoo and skipjack tuna, and also lands bycatch of sailfish, spearfish, kawakawa, albacore, rainbow runner and sharks. Nearshore trolling target higher level carnivores such as jacks, baracuda, and other predators. Up to six lines rigged with artificial lures may be trolled when outrigger poles are used to keep the lines from tangling. Trolling gear usually consists of short, stout fiberglass poles and lever-drag hand-cranked reels. In addition to lures, trollers occasionally use live or dead bait. For example, small tuna are used to attract marlin, which is the prized catch for chartered vessels. Bigeye scad, mackerel scad, or strips of skipjack tuna are often used when a school of dolphinfish is encountered. Shallow water trolling uses juvenile goat fish or "oama" or juvenile scad



“halalu”. When using live bait, the vessel slows to allow the bait to swim naturally.

Another form of pelagic trolling utilizes a single large fiberglass pole in the center of the vessel called a “green stick”. A large wooden or plastic lure, often referred to a “bird”, is trolled on the surface behind the vessel. The bird is attached to the green stick with heavy monofilament or nylon line. A series of plastic squid lures with single hooks are attached to a separate main line. The squid lures are then attached to the green stick line with rubber bands allowing the lures to skip along the surface of the ocean. When trolled properly, the bird creates excessive surface agitation and appears to be chasing the squid lures which skim along the surface. When fish take the lure, the line breaks away and the fish is fought separately on a rod and reel or by hand.

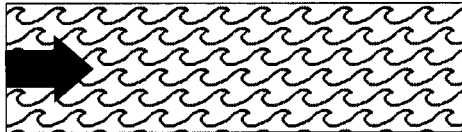
Trollers fish in areas where water masses converge and where the underwater topography changes dramatically, such as near submarine cliffs or oceanic seamounts. Trollers also frequent fish aggregation devices (FADs), or search for drifting logs or flotsam that aggregate tunas, dolphinfish and wahoo. The various segments of the fishery use the same gear and techniques, but differ in catch composition, vessel size, fishing effort and catch disposition. Charter boats target and catch more marlin (40-50% by weight) while non-charter commercial trollers target and catch more yellowfin (about 80% by weight). Charter boats typically measure 30-45 ft whereas non-chartered trolling vessels are usually trailered boats ranging from 15-25 ft in length. Full-time commercial vessels that are not engaged in charters expend the most effort, with an average trip lasting more than eight hours, whereas charterboats stay out 4-8 hr/trip. Part-time commercial and recreational vessels typically fish about 6 hr/trip. In Hawaii, about 70% of the charterboat catch, and 60% of the “recreational” and part-time commercial catch, is sold for food.

Commercial albacore trollers tow 12-18 lines simultaneously from the vessels’ stern and from long outrigger poles mounted amidships. The line lengths or depths are adjusted or to permit hauling of any one line without tangling or interfering with the others. The lines are either braided polypropylene, dacron or monofilament nylon and are pulled by hand or hydraulic haulers. Lures have metal heads and feather or plastic skirts, and are rigged with barbless double hooks. Troll vessels never stop when fishing during the day, but may slow and make tight circles or short, straight runs when fishing on an albacore school. Fish are hauled directly to the stern of the vessel where they are quickly taken from the water and unhooked before being stored whole in blast or spray brine freezer holds.

Albacore vessels usually drift at night or steam toward promising fishing grounds as determined by recent fishing activity, sea surface temperatures, or observations of baitfish and albacore on sonar or depth sounding equipment. The use of cooperative, or “code”, groups also increases efficiency of the fleet. At dawn, the jigs are deployed and the rest

of the day is a continuous cycle of pulling fish, changing lures, storing the catch, and searching for birds, water temperature fronts or other vessels that might indicate productive fishing areas. At dusk, the jigs are retrieved and stored for the next day of fishing.

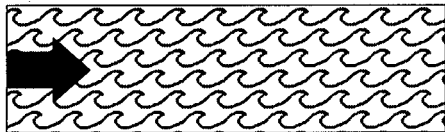
### **Habitat Impacts:**



Low                      Med                      High

Trolling has no impact on habitat.

### **Bycatch:**



Low                      Med                      High

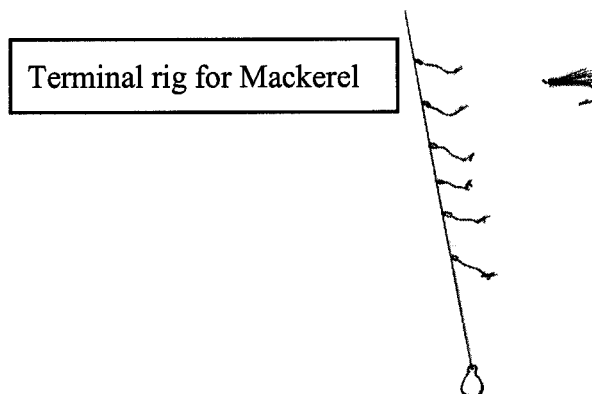
Trolling has very few, if any, bycatch. Trolling effectively targets high level predators which are sought after for consumption or recreation.

# Fishing Gear Catalogue

## Hook and Line

**Gear Type:** Handline (Big eye/scad/Akule/Atulai/Atule/Mackerel)

**Diagram of typical gear:**

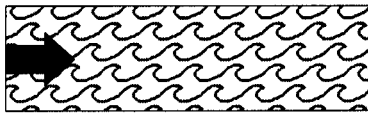


**Deployment/retrieval:**

Handline fishing is an old technique used to catch akule/atulai/mackerel with simple gear and small boats. The mainline consists of 300 feet of 30 pound test monofilament that is laid in a basket to avoid tangling. The terminal rig can vary but generally is made using 15-20 feet of 20 pound monofilament to which a 3-9 ounce weight is attached. Six or seven small loops are made in the line by tying two overhand knots in 1 foot intervals along the line. Leaders of 6-8 pound test to which hooks are attached are tied to the loops. Artificial lures, such as plastic curly tails with glow beads or nylon strands tied to the hooks with red string, are common for this type of fishing. Japanese ready made leaders can be purchased from fishing stores.

Fishing is conducted at night, moonless nights are generally more productive. Boats anchor in depths of 40 to 50 fathoms before dark or in the early evening. Lights are shown on in the water to attract bait which will in turn attract the mackerel. Mackerel primarily aggregate between 25-75 feet from the surface. The handline rig is dropped to these depths and retrieved slowly by jiggling it to the surface. Although there are multiple hooks, fish are brought to the surface once hooked to reduce chances of predators taking the fish or chances of the fish breaking the leader. Once fish start biting, the light is dimmed to concentrate the school below the boat.

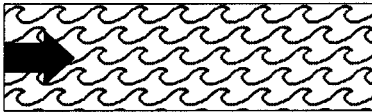
### Habitat Impacts:



Low                  Med                  High

Mackerel handling gear has minimal habitat impacts. All gear is deployed in the water column without impacting the bottom substrate.

### Bycatch:



Low                  Med                  High

Bycatch is extremely minimal. The handline fishery is active year-round, and many handliners also participate in the bottomfish and troll fisheries.