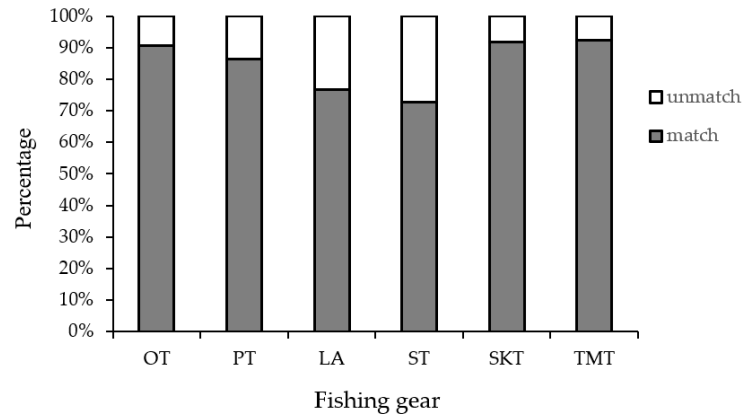
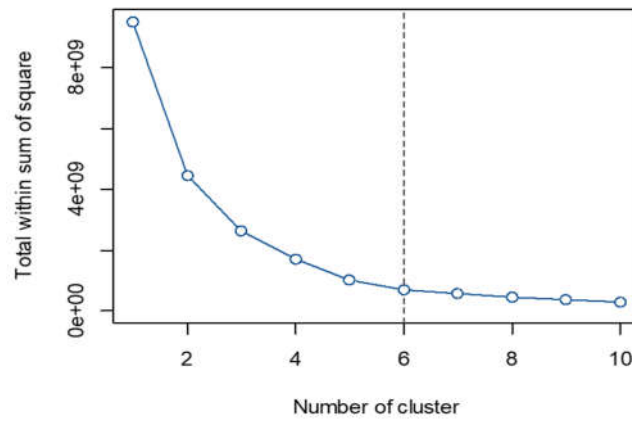


## Supplementary

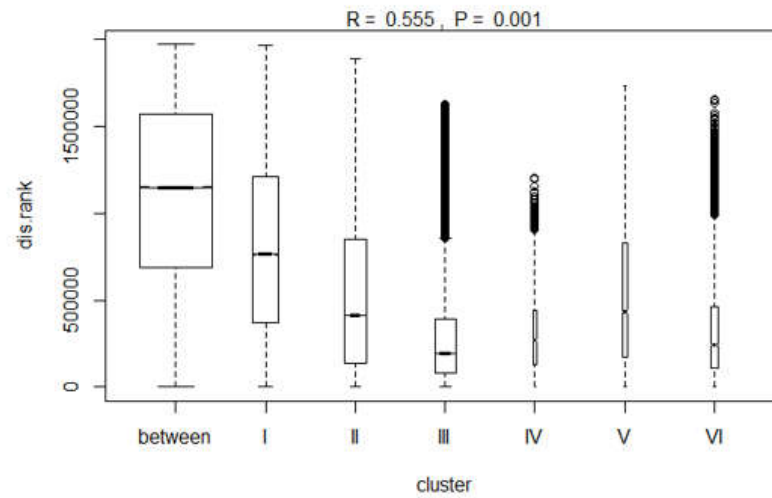


**Figure 1.** The percentage of landing data that matched with the VDR records for trips by fishing gear in the study period.

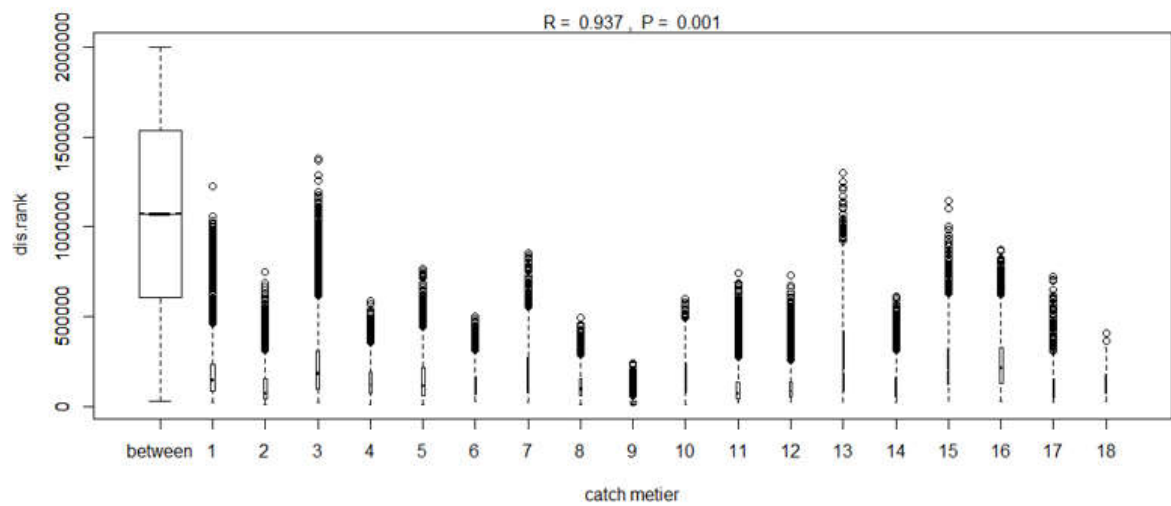


**Figure 2.** The scree plot of within cluster distance sum of squares.

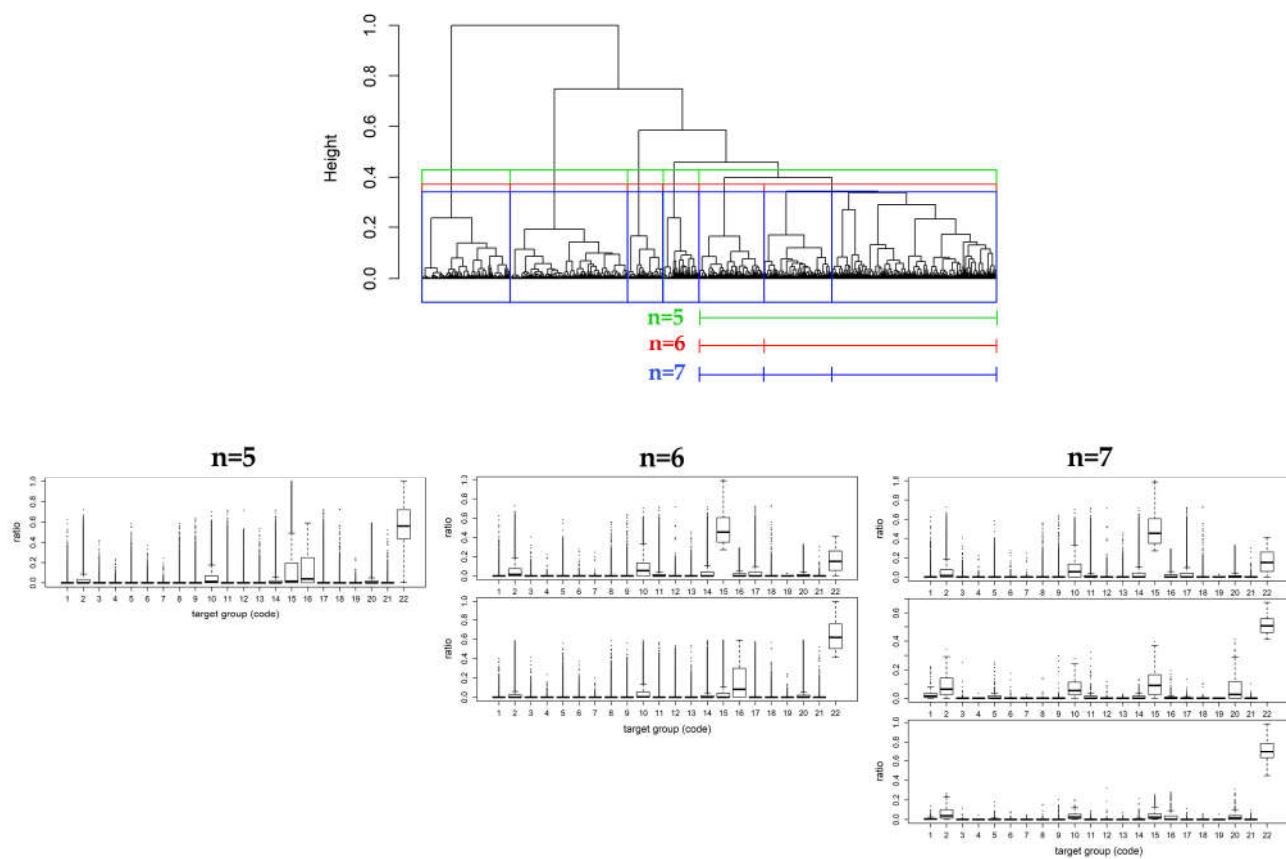
(a)



(b)

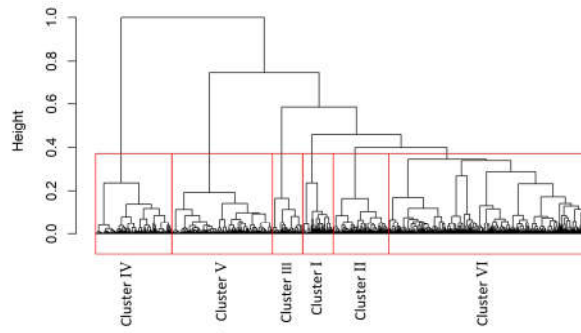


**Figure 3.** ANOSIM plot of the (a) 6 target group clusters and (b) 18 catch métiers with statistic  $R$  and  $p$ -value based on catch composition in landing data.

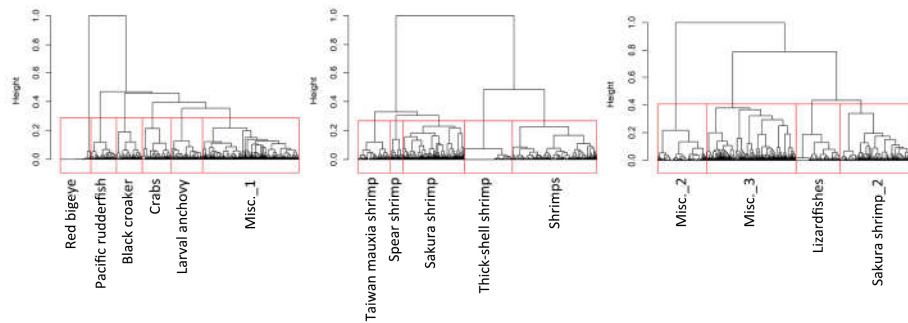


**Figure 4.** Diagram of change of target group composition profiles from different cluster numbers. The 6 clusters were determined to clearly separate the trips that mainly target cephalopods (code 15) and miscellaneous (code 22).

step 1



step 2



**Figure 5.** Diagram of the two-step clustering process. We determined 6 clusters and interpreted the group of trips to target homogenous fishery resources (low-resolution data of target group) in the first step. Given the huge number of trips and fuzzy hidden catch information in Clusters IV, V, and VI, cluster analysis was conducted using species composition in the second step.

**Table 1.** The species for the target group of the trawler fishery in coastal and offshore water off Taiwan. Target groups aggregated homogeneous species according to taxonomy (target group code 1-21). Species with low economic value but frequently caught are shown in the miscellaneous group (code 22). Main fishery resources are presented for the trawler fishery.

Code	Target Group	Common Name	Scientific Name
1	Mackerels	Blue mackerel	<i>Scomber australasicus</i>
		Chub mackerel	<i>Scomber japonicus</i>
		Other mackerels	Scombridae
2	Jacks and scads	Black pomfret	<i>Parastromateus niger</i>
		Greater amberjack	<i>Seriola dumerili</i>
		Japanese jack mackerel	<i>Trachurus japonicus</i>
		Japanese scad	<i>Decapterus maruadsi</i>
		Redtail scad	<i>Decapterus kurroides</i>
		Scomberoides	<i>Scomberoides</i> spp.
		Shrimp scad	<i>Alepes djedaba</i>
		Snubnose pompano	<i>Trachinotus blochii</i>
3	Bonitos	Torpedo scad	<i>Megalaspis cordyla</i>
		Other jack and scads	Carangidae
		Bullet tuna	<i>Auxis rochei</i>
		Frigate tuna	<i>Auxis thazard</i>
		Skipjack tuna	<i>Katsuwonus pelamis</i>
		Other bonitos	Scombridae

4	Tunas	Albacore	<i>Thunnus alalunga</i>
		Bigeye tuna	<i>Thunnus obesus</i>
		Southern bluefin tuna	<i>Thunnus maccoyii</i>
		Yellowfin tuna	<i>Thunnus albacares</i>
		Other tunas	Scombridae
5	Seer fish	Indo-Pacific king mackerel	<i>Scomberomorus guttatus</i>
		Japanese spanish mackerel	<i>Scomberomorus niphonius</i>
		Korean seerfish	<i>Scomberomorus koreanus</i>
		Narrow-barred Spanish mackerel	<i>Scomberomorus commerson</i>
		Other seer fish	Scombridae
6	Marlins	Black marlin	<i>Istiompax indica</i>
		Blue marlin	<i>Makaira nigricans</i>
		Indo-Pacific sailfish	<i>Istiophorus platypterus</i>
		Striped marlin	<i>Kajikia audax</i>
		Swordfish	<i>Xiphias gladius</i>
7	Dolphinfish	Other marlins	Istiophoridae
		Dolphin fish	<i>Coryphaena hippurus</i>
8	Sharks	Blue shark	Prionace glauca
		Hammerhead	Sphyrnidae
		Requiem sharks	<i>Carcharhinus</i> spp.
		Shortfin mako	<i>Isurus oxyrinchus</i>
		Thresher sharks	Alopiidae
9	Rays and skates	Other sharks	Selachimorpha
		Rays and skates	Dasyatidae; Rajidae; Myliobatidae
10	Seabreams and snappers	Blackhead seabream	<i>Acanthopagrus schlegelii</i>
		Crimson snapper	<i>Lutjanus erythropterus</i>
		Emperors	Lethrinidae
		Flame snapper	<i>Etelis coruscans</i>
		Fusiliers	Caesionidae
		Goatfishes	Mullidae
		Jarboa terapon	<i>Terapon jarbua</i>
		Mangrove red snapper	<i>Lutjanus argentimaculatus</i>
		Parrotfishes	Scaridae
		Red bigeye	<i>Priacanthus macracanthus</i>
		Red seabream	<i>Pagrus major</i>
		Rock porgy	<i>Oplegnathus punctatus</i>
		Silver seabream	<i>Rhabdosargus sarba</i>
		Star snapper	<i>Lutjanus stellatus</i>
		Threadfin porgy	<i>Evynnis cardinalis</i>
11	Butterfishes	Yellowback seabream	<i>Dentex hypselosomus</i>
		Yellowfin seabream	<i>Acanthopagrus latus</i>
		Other seabreams	Sparidae
		Other snappers	Lutjanidae
		Butterfish	<i>Pampus echinogaster</i>

		Pacific rudderfish	<i>Psenopsis anomala</i>
		Silver pomfret	<i>Pampus argenteus</i>
		Other butterfishes	Stromateidae
		Gizzard shad	<i>Nematalosa</i> spp.
		Larval anchovy	<i>Engraulis japonicus</i> ; <i>Encrasicholina punctifer</i> ; <i>Encrasicholina heteroloba</i>
12	Anchovies and sardines	Red-eye round herring	<i>Etrumeus teres</i>
		Sardines	<i>Sardinella</i> spp.
		Silver-stripe round herring	<i>Spratelloides gracilis</i>
		Other herrings & sardines	Clupeidae
		Brown-marbled grouper	<i>Epinephelus fuscoguttatus</i>
		Giant grouper	<i>Epinephelus lanceolatus</i>
13	Groupers	Malabar grouper	<i>Epinephelus malabaricus</i>
		Orange-spotted grouper	<i>Epinephelus coioides</i>
		Other groupers	Serranidae
		Black croaker	<i>Atrubucca nibe</i>
		Large yellow croaker	<i>Larimichthys crocea</i>
		Mi-iuy croaker	<i>Miichthys miiuy</i>
14	Croakers	Silver croaker	<i>Pennahia argentata</i> ; <i>Argyrosomus japonicus</i>
		Tigertooth croaker	<i>Otolithes ruber</i>
		Yellow croaker	<i>Larimichthys polyactis</i>
		Other croakers	Sciaenidae
		Argentine shortfin squid	<i>Illex argentinus</i>
		Bigfin reef squid	<i>Sepioteuthis lessoniana</i>
15	Cephalopods	Cuttlefishes	Sepiidae
		Jumbo squid	<i>Dosidicus gigas</i>
		Neritic squid	Loliginidae
		Octopus	Octopodidae
		Squids	Ommastrephidae
		Big head shrimp	<i>Solenocera alticarinata</i>
		Grass shrimp	<i>Penaeus monodon</i>
		Kuruma shrimp	<i>Penaeus japonicus</i>
		Lobsters	Palinuridae
		Red tail shrimp	<i>Penaeus penicillatus</i>
		Sakura shrimp	<i>Lucensosergia lucens</i>
16	Shrimps	Sand shrimp	<i>Metapenaeus ensis</i>
		Slipper lobster	<i>Ibacus ciliatus</i>
		Southern rough shrimp	<i>Trachysalambria curvirostris</i>
		Spear shrimp	<i>Parapenaeus</i> spp.
		Taiwan mauxia shrimp	<i>Acetes intermedius</i>

		Thick-shell shrimp	<i>Metapenaeopsis barbata</i>
		Whiteleg shrimp	<i>Penaeus vannamei</i>
		Other shrimps	
		Blue swimming crab	<i>Portunus pelagicus</i>
		Crucifix crab	<i>Charybdis feriatus</i>
		Mud crab	<i>Scylla serrata</i>
17	Crabs	Spanner crab	<i>Ranina ranina</i>
		Three-spot swimming crab	<i>Portunus sanguinolentus</i>
		Other crabs	
18	Ocean sunfish	Molas	Molidae
19	Snake mackerels	Snake mackerel	Gempylidae
20	Hairtails	Hairtails	<i>Trichiurus</i> spp.
		Grey mullet	<i>Mugil cephalus</i>
21	Mullets	So-iuy mullet	<i>Chelon haematocheilus</i>
		Mullets	Mugilidae
		Filefishes	Monacanthidae
		Barracudas	Sphyraenidae
		Cichlids	Cichlidae
		Cobia	<i>Rachycentron canadum</i>
		Flatfishes	Pleuronectiformes
		Flyingfishes	Exocoetidae
		Formosan babylon	<i>Babylonia formosae</i>
		Giant perch	<i>Lates calcarifer</i>
		Golden threads	<i>Nemipterus</i> spp.
		Grass carp	<i>Ctenopharyngodon idella</i>
		Halfbeaks	Hemiramphidae
		Hard clam	<i>Meretrix lusoria</i>
		Japanese eel	<i>Anguilla japonica</i>
		Japanese seabass	<i>Lateolabrax japonicus</i>
		Lizardfishes	Synodontidae
22	Miscellaneous (Misc.)	Milkfish	<i>Chanos chanos</i>
		Monocle breams	<i>Scolopsis</i> spp.
		Moonfish	<i>Mene maculata</i>
		Moray eels	Muraenidae
		Oyster	<i>Crassostrea gigas</i>
		Pacific saury	<i>Cololabis saira</i>
		Ponyfishes	Leiognathidae
		Sea chubs	Kyphosidae
		Sea urchin	Echinoidea
		Sharp-toothed eel	Muraenesocidae
		Short-necked clam	<i>Tapes</i> spp.
		Sillagos	Sillaginidae
		Spotted catfish	<i>Arius maculatus</i>
		Spotted scat	<i>Scatophagus argus</i>
		Surgeonfishes	Acanthuridae
		Threadfins	Polynemidae
		Tilefishes	<i>Branchiostegus</i> spp.
		Wolf-herrings	Chirocentridae

Other eels (Hag-fishes 、Conger eels 、Snake eels)  
 Other perches  
 Other marine fishes  
 Other shellfishes

Myxinidae;  
 Congridae;  
 Ophichthidae  
 Percidae

**Table 2.** Fishing speed criterion by gear type for the trawler fishery in Taiwan.

Fishing Gear	Fishing Speed (Knot)
Otter Trawl (OT)	1.7 ~ 4.5
Pair Trawl (PT)	1 ~ 5
Pelagic Pair Trawl of Larval Anchovy (LA)	0.6 ~ 3.4
Shrimp Trawl (ST)	2 ~ 4
Sakura Shrimp Trawl (SKT)	1.3 ~ 3.6
Taiwan Mauxia Shrimp Trawl (TMT)	0.3 ~ 4.7

**Table 3.** The total sums of squares within the groups and the difference (percentages) for various groups of clusters. Six clusters were determined in this study.

Cluster Number	Sum of Square	Difference	Difference %
1	9,528,575,118		
2	4,442,181,793	5,086,393,325	0.551
3	2,623,854,726	1,818,327,067	0.197
4	1,695,827,629	928,027,097	0.100
5	1,033,636,435	662,191,194	0.072
6	714,261,892	319,374,543	0.035
7	569,015,230	145,246,662	0.016
8	457,511,593	111,503,637	0.012
9	376,557,832	80,953,761	0.009
10	303,959,878	72,597,954	0.008
total		9,224,615,240	



