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Manatū Ahu Matua

Summary of: Review of research and monitoring studies on New Zealand sharks, skates, **rays and chimaeras, 2008–2012**

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CONTEXT

The Francis and Lyon (2012) report above was commissioned by the Ministry for Primary Industries (MPI) with the aim of collating and summarising information in support of a review of the National Plan of Action for the Conservation and Management of Sharks 2008 (NPOA – Sharks)". The report firstly introduces the study, and then states methods. It then provides sources structured by information categories synthesised into concise, informative summaries that included a bibliographic reference, list of the species covered, a description of the methods, the major results and conclusions, and an assessment of the study's limitations (where known). The document then summarises the research and identifies both the achievements against the NPOA actions and research gaps. It also provides a full list of references and an appendix that summarises the studies by relevant species and information categories. This study is thorough, but 74 pages long, therefore this summary document was produced; it is less comprehensive, more summative and shorter. This summary is an appropriate companion document to the NPOA-Sharks review 2012 for a less technical (or more time-constrained) audience than Francis and Lyon (2012).

This summary document therefore outlines the introduction and methods from Francis and Lyon (2012) then captures the salient points from the two following results sections: *3.1 Summary of research 2008-2012*, and *3.3 NPOA achievements and identification of research gaps*. *Section 3.2 NPOA achievements* is covered in another companion document to the NPOA – Sharks 2012; '*Review of actions form NPOA – Sharks 2008*'. This summary document also illustrates some of the points made by Francis and Lyon (2012) by referring to selected studies or data from the appendix of that document. This document frequently copies verbatim from Francis and Lyon (2012).

INTRODUCTION

The NPOA – Sharks (2008) contains a requirement to conduct a review of its achievements in 2012. To inform that review, there is a need to identify, collate, analyse and summarise the actions carried out under the umbrella of the NPOA since 2008. This document summarises the most important points from a source document (Francis and Lyon 2012) whose purpose was to complete that review for actions relevant to research and monitoring (this report does not cover actions related to compliance and management).

The specific objectives for this document were:

1. To collate and summarise information in support of a review of the National Plan of Action for the Conservation and Management of Sharks (NPOA – Sharks).
2. To identify research gaps from Objective 1 and suggest cost-effective ways these could be addressed.

In the NPOA, "sharks" are defined to include all chondrichthyans, viz. sharks, rays, skates and chimaeras. The scope of this report follows that of the NPOA in covering all chondrichthyans occurring in or passing through New Zealand waters (including the Ross Sea, Antarctica), and species caught by from New Zealand vessels fishing on the High Seas. Only research and monitoring studies that have been completed to final report stage since the NPOA came into effect (2008) are included.

METHODS

In Francis and Lyon (2012) published and unpublished literature were searched for research and monitoring studies carried out on chondrichthyans in New Zealand waters since 2008.

The following main categories of information were sought in this review:

- taxonomic description of chondrichthyans;
- identification guides to chondrichthyans;
- genetics studies of species and stocks;
- geographical and depth distribution, movements and migrations, and habitat requirements;
- food and feeding;
- age, growth, reproduction and productivity;
- fishery characterisations, trends in catches, conversion factors used to convert processed weight to whole weight, catch per unit effort (CPUE), and catch composition;
- trawl surveys to monitor distribution, abundance and population composition;
- stock assessment and stock status;
- mitigation of human impacts.

Information sources were classified into one of the above categories. Some sources covered more than one category, but each source was assigned to the single most appropriate category. Only sources that provided new data or information, or performed a relevant and useful review of existing information (in the authors opinion), were included.

This review focused upon the achievements of the NPOA by comparing the action list in Section 4 of the NPOA with the review of research and monitoring studies carried out in the last five years (see Results section). It identified which actions have been partially or fully completed and which gaps still require attention, and made recommendations of cost-effective ways of addressing these gaps.

RESULTS

Summary of research 2008–2012

The 107 studies reviewed in Francis and Lyon (2012) varied greatly in the amount of information provided and the analyses conducted. Some studies presented minimal data whereas others were intensive studies (e.g. stock assessment, which aims to estimate and forecast the number of sharks within a fisheries area) of individual species. More than two-thirds (71%) of the 107 identified studies fell into four categories: “Genetics”, “Distribution, movements and habitat”, “Fisheries, catches, catch per unit effort, and catch composition” and “Trawl survey monitoring” (Table 1). There were few studies covering the other six categories. However, a simple count does not necessarily reflect the relative importance and value of the studies. The two largest categories were broad in scope, which undoubtedly enhanced their numerical importance and the four identification guides covered the widest range of species compared to all other categories.

Table 1: Number of New Zealand chondrichthyan studies from 2008 to 2012, classified by whether they were original or review studies, and by 10 information categories. Review studies are those that do not contain any original data or analyses. The numbers of species included in the studies are also shown. Minor species are not included. (Source: Francis and Lyon 2012)

Information category	Number of original studies	Number of review studies	Number of species
Fisheries, catches, CPUE, catch composition	29	1	29
Distribution, movements and habitat	21	1	36
Trawl survey monitoring	13	2	33
Genetics	11	1	15
Feeding	7	0	19
Age, growth, reproduction and productivity	6	1	9
Identification guides	4	0	73
Taxonomy	4	0	4
Stock assessment and status	2	2	14
Mitigation	2	0	3
Total	101	6	83

A paragraph on each of these information categories follows (using the order from Table 1) with a brief description of those studies. This is followed by one paragraph which indicates how these studies were distributed throughout the 113[1] (Appendix 1) known species of New Zealand chondrichthyans.

Thirty studies have carried out fishery characterisations and CPUE analyses, and investigated catch composition. Species covered include pelagic (oceanic) sharks (mainly blue, porbeagle and mako sharks), spiny dogfish, basking shark, deepwater sharks, skates and chimaeras caught as bycatch in various trawl and longline fisheries, and school shark, rig and elephantfish caught in target and bycatch fisheries. A survey of relative abundance and catch composition of rig in SPO 7[2] was conducted over three consecutive years by the fishing industry. The annual Report from the Fisheries Assessment Plenary (MPI 2012) provides catch histories, and summaries of productivity, abundance and stock status, for all Quota Management System (QMS) chondrichthyans.

A wide range of studies investigated the distribution of species, their movements, and the habitats occupied. Techniques used included tagging (ranging from simple plastic tags to high-tech electronic tags), and trawl, set net and diver surveys.

Time series of trawl surveys have been conducted off east coast South Island, west coast South Island, Chatham Rise, and the Subantarctic at annual or biennial intervals. A total of 13 individual surveys have been reported, and there have been comprehensive reviews for the Chatham Rise and Subantarctic survey series, resulting in summaries of relative biomass estimates, distribution, and size composition for 33 chondrichthyan species.

Twelve genetic studies addressed questions of species identification, fish product identification, and the amount of geographic isolation or mixing of shark species.

Six feeding studies have been carried out on a suite of middle depth to deepwater sharks (those generally found in >200m depths), skates and chimaeras, mainly using stomach content

[1] Francis & Lyon report 119 species, this includes 4 species of Antarctic skates, and 2 species which have since been determined to have been mis-identified and removed from the list of New Zealand species.
[2] SPO7 covers the west coast of the South island (above Fiordland) and the Northern South Island, see http://fs.fish.govt.nz/Page.aspx?pk=8&stock=SPO3 for a map of SPO fisheries areas, although other information on that page may be outdated.

data collected during Chatham Rise trawl surveys. Another study investigated food and feeding behaviour of juvenile rig in estuaries around New Zealand.

Age and growth studies have been conducted for the leafscale gulper shark and shovelnose dogfish. Biological parameters have been reviewed and updated for Antarctic skates and porbeagle sharks. An international study of the population recovery potential of deepwater sharks, skates and chimaeras after fishing included five New Zealand shark species. Incubation times and hatching dates were estimated for elephantfish.

Four identification guides were published; they covered 73 species of chondrichthyans (61% of the known fauna). The guides described and illustrated all of the common and many of the rare species which are encountered in fishing operations around New Zealand.

Four new species of chondrichthyans were described (one each of ghost shark, cat shark, lantern shark, and skate). All were relatively rare species.

One full stock assessment was completed for rig in SPO 3[3]. Stock status was assessed using International Union for Conservation of Nature (IUCN) threatened species criteria for 13 species of pelagic sharks and ray that occur in New Zealand. Ecosystem indicators were reviewed for their utility in assessing New Zealand fish stocks.

Two studies seeking to mitigate the impacts of human activities on bycatch species were carried out. One covered spinetail devil rays and manta rays taken as bycatch in the tuna purse seine fishery, and the other identified threats to rig nursery areas.

A full list of the 113 known species of New Zealand chondrichthyans is given in Appendix 1 of Francis and Lyon (2012), along with an indication of their occurrence in each of the 10 information categories. Twenty-seven species (nine QMS and 18 non-QMS) occurred in four or more categories. Eighty-three species (70%) occurred in at least one study, and 36 species (30%) occurred in none.

NPOA research gaps and recommendations

Research and monitoring actions specified in the NPOA that were not completely addressed are summarised below, and recommendations made by Francis and Lyon (2012) for additional research during the next five years to fill these gaps are listed.

NPOA Section 4.1: Produce a field identification guide

Identification guides that cover 61% of New Zealand's chondrichthyans are now available. Francis and Lyon (2012) recommend that it would be desirable to extend the coverage to the more common remaining species. This would assist observers, research staff and fishers to collect data on the biology, distribution and abundance of rare species, some of which are endemic to (only occurring in) New Zealand. These species are not important in terms of catch quantity, but if their occasional capture as bycatch is significant in relation to their population size or biological productivity, it may lead to population decline.

NPOA Section 4.2: Reduce use of generic shark reporting codes

Now that good identification guides are available for all of the common and many of the rare chondrichthyans, fishers have the information required to accurately identify most of their catch. Francis and Lyon (2012) recommend that MPI should ensure the identification guides are distributed widely to the fishing industry, including in electronic form as many larger

[3] SPO3 covers all of the fishery to the EEZ south of Marlborough on the east coast and Fiordland on the West Coast of the South Island the west coast of the South island, see http://fs.fish.govt.nz/Page.aspx?pk=8&stock=SPO3 for a map of SPO fisheries areas, although other information on that page may be outdated.

vessels have computers on board. The main users of generic codes should be identified and special effort should be made to encourage the skippers and crew of these vessels to record their catch to species level. It should be made clear that generic codes are a last resort. MPI should regularly monitor and discourage the use of generic codes during the term of the next NPOA.

NPOA Section 4.3: Strengthen existing research and monitoring programmes

Francis and Lyon (2012) recommend that the four trawl survey series underway around southern New Zealand should be maintained as they are an important and often the only monitoring tool for many demersal (living at or near the seafloor) chondrichthyans, particularly deepwater sharks, skates and chimaeras. There are no analogous trawl surveys operating around the North Island which leaves a huge gap there in our knowledge of the chondrichthyan populations. Some QMS species (spiny dogfish, rough and smooth skates, dark and pale ghost sharks) and non-QMS bycatch species (northern spiny dogfish, stingrays, eagle rays, carpet sharks, and deepwater sharks, skates, and chimaeras) are not being monitored around the North Island. Consideration should be given to reinstating North Island trawl surveys on a periodic basis, e.g. two consecutive annual surveys every 5–8 years to provide occasional relative biomass estimates. There is a good historical time series of *Kaharoa* inshore surveys, and a series of deepwater surveys by *Wanaka* in 1985–86, to provide a temporal comparison. The *Wanaka* surveys identified major spatial variability in the size and sex composition of deepwater sharks, especially shovelnose dogfish, indicating that some population components (e.g. mature females) are geographically constrained and may be vulnerable to intensive localised fishing. Reinstating periodic North Island surveys will also have benefits for monitoring many teleost fishes.

Standardised CPUE analyses are routinely conducted for the main stocks of rig, school shark and elephantfish and Francis and Lyon (2012) anticipate that they will continue at regular intervals of several years. The first CPUE analysis for pale ghost shark has recently been conducted and a similar analysis for dark ghost shark is anticipated in 2013. CPUE analyses for these ghost sharks should are recommended by Francis and Lyon (2012) be conducted at regular intervals. CPUE analyses are regarded as important for some spiny dogfish stocks (see MPI 2012) but have not been updated since 2005–06, and the results of that study (Manning et al. 2009) have not been incorporated into the Plenary Report. As data quality improves, including better recording of discards, CPUE analyses for spiny dogfish should provide better indices of relative abundance. The same may apply to deepwater sharks as species identification improves and the use of generic codes declines. Many other stocks and species may be suitable candidates for standardised CPUE analyses. Francis and Lyon (2012) recommend that a review of major catch and bycatch species be undertaken to determine which additional species are amenable to CPUE analysis, and that analyses be completed for those species.

Only one quantitative stock assessment was carried out for a chondrichthyan species during the term of the NPOA, and this is clearly a research gap that needs to be addressed. However, stock assessments are complex, expensive, and dependent on the availability of specific input data. Some chondrichthyan species, and many stocks, will never be suitable candidates for assessment. Conversely, stock assessment is an achievable goal for major stocks of some species, provided that suitable input data are collected, collated and analysed. Francis and Lyon (2012) recommend that a review should be conducted to determine which species and stocks are (a) amenable to quantitative assessment at present, and (b) potentially amenable to quantitative assessment in the next 3–5 years as improved input data become available. Species and stocks that are not suitable or have low priority should be risk assessed using currently available information on their productivity and vulnerability; potential assessment methods include intrinsic rebound potential (e.g. Simpfendorfer and Kyne (2009)) and Productivity Susceptibility Analysis (http://nft.nefsc.noaa.gov/PSA_pgm.htm).

Stock assessments require a relative abundance index (absolute abundance estimates are difficult or impossible to obtain for most chondrichthyans) such as a CPUE index or trawl survey biomass index (see above for recommendations on these). Other required input data include catch histories, catch composition, and biological parameters such as growth, natural mortality and fecundity rates. These data are available for some species, and are being collected for others. Examples of the latter include vertebrae and fin spines being collected by observers from blue, porbeagle and mako sharks, rig, and elephantfish, and stored for later age estimation. However, the quantities collected so far are small and not representative of the fisheries. A major issue is the low and unrepresentative observer coverage in many fisheries, and the low priority given to data and sample collection from chondrichthyan bycatch species. Francis and Lyon (2012) recommend that a target set of species and fisheries be established for implementing intensive data collection in preparation for future stock assessments. Maturity and reproductive stage data are now being routinely collected from deepwater sharks and chimaeras on research trawl surveys. Francis and Lyon (2012) recommend that the value and quality of these data should be assessed, and if appropriate, data collection should be extended to observers on commercial trawlers, longliners and set netters. Furthermore, ageing techniques are not available for many deepwater species, and none of the existing ageing techniques has been validated. Francis and Lyon (2012) recommend that a research plan to develop, and validate where possible, ageing techniques for a range of species should be drawn up and implemented.

Catch histories back to 1931 are being developed for inshore chondrichthyans (mainly rig, school shark, spiny dogfish, northern spiny dogfish, rough and smooth skate, and elephantfish) under a current MPI research project. Unfortunately several small sharks were historically lumped under generic species names, and catches are known to have been under-reported prior to 1986. Hence the catch histories will be approximate only. Francis and Lyon (2012) recommend that attempts should also be made to develop catch histories for deepwater species for which adequate records exist, although unreported discards will be problematic.

Francis and Lyon (2012) recommend that information being collected on the life status and discards of pelagic sharks and chondrichthyans taken as bycatch in deepwater fisheries should be collated and summarised to estimate minimum mortality rates of discarded fish (maximum mortality rates cannot be estimated without a tagging programme to determine how many live releases subsequently die). Sixth Schedule species should form a major part of the study in order to review the effectiveness of that management tool.

Francis and Lyon (2012) recommend that data being collected by observers on processed states of chondrichthyans should be analysed to monitor trends in species utilisation. Concurrently, any information suitable for conversion factor estimation should be analysed. Priority should be given to providing observers on tuna longline vessels with motion-compensated electronic scales in order to estimate shark fin (and other processed state) conversion factors for individual sharks; currently we have negligible data on how these conversion factors vary with size, sex and individual vessel processing method. Observers have been collecting fin weight data using spring balances, but because of the inaccuracy of these balances in anything other than a calm sea, the data are only useful when aggregated across multiple sharks.

Francis and Lyon (2012) recommend that the distribution of nursery grounds for school shark and elephantfish should be surveyed and defined, and attempts made to mitigate human impacts on them. These two species are the main species (other than rig which has recently been surveyed) that use shallow coastal waters for nurseries and are therefore likely to be vulnerable to human impacts. Research and observer data on deepwater sharks, skates and chimaeras should also be analysed to identify locations supporting numbers of juveniles or adult females with a view to reducing fishing mortality on vulnerable life history stages.

The very useful series of diet studies carried out for chondrichthyans on the Chatham Rise (Dunn et al 2010a; 2010b; 2012; Forman and Dunn 2012) has provided important new information on diet and how that varies with size and season, and the trophic interactions of chondrichthyans with their prey and predators. Francis and Lyon (2012) recommend that such studies need to be expanded to a wider range of species (particularly inshore species) and locations (particularly west coast South Island and North Island). Spatial variation in diet is likely so Chatham Rise results will not be representative of diets elsewhere.

Francis and Lyon (2012) recommend that the effects of fishing on small, rare and uncommon chondrichthyans should be examined carefully as these species may be highly vulnerable and may be heavily impacted without anyone noticing. Some species are endemic and warrant particular attention.

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APPENDIX I

Table 1: List of shark species found in New Zealand waters

Compiled and maintained by Malcolm Francis (NIWA) with input from Andrew Stewart (Te Papa), Clinton Duffy (DOC) and Peter McMillan (NIWA).

Group	Family	Species	Common name
Chimaera	Callorhinchidae	*Callorhinchus milii* Bory de St Vincent, 1823	Elephantfish
Chimaera	Rhinochimaeridae	*Harriotta haeckeli* Karrer, 1972	Smallspine spookfish
Chimaera	Rhinochimaeridae	*Harriotta raleighana* Goode & Bean, 1895	Longnose spookfish
Chimaera	Rhinochimaeridae	*Rhinochimaera pacifica* (Mitsukuri, 1895)	Pacific spookfish
Chimaera	Chimaeridae	*Chimaera lignaria* Didier, 2002	Purple chimaera, giant chimaera
Chimaera	Chimaeridae	*Chimaera panthera* Didier, 1998	Leopard chimaera
Chimaera	Chimaeridae	*Chimaera* sp.	Brown chimaera, longspine chimaera
Chimaera	Chimaeridae	*Hydrolagus bemisi* Didier, 2002	Pale ghost shark
Chimaera	Chimaeridae	*Hydrolagus homonycteris* Didier 2008	Black ghost shark
Chimaera	Chimaeridae	*Hydrolagus novaezealandiae* (Fowler, 1910)	Dark ghost shark
Chimaera	Chimaeridae	*Hydrolagus trolli* Didier and Seret, 2002	Pointynose blue ghost shark
Chimaera	Chimaeridae	*Hydrolagus* sp. D [Didier]	Giant black ghost shark
Shark	Chlamydoselachidae	*Chlamydoselachus anguineus* Garman, 1884	Frill shark
Shark	Hexanchidae	*Heptranchias perlo* (Bonnaterre, 1788)	Sharpnose sevengill shark
Shark	Hexanchidae	*Hexanchus griseus* (Bonnaterre, 1788)	Sixgill shark
Shark	Hexanchidae	*Notorynchus cepedianus* (Peron, 1807)	Broadnose sevengill shark
Shark	Echinorhinidae	*Echinorhinus brucus* (Bonnaterre, 1788)	Bramble shark
Shark	Echinorhinidae	*Echinorhinus cookei* Pietschmann, 1928	Prickly shark
Shark	Squalidae	*Cirrhigaleus australis* White, Last & Stevens, 2007	Southern mandarin dogfish
Shark	Squalidae	*Squalus acanthias* Linnaeus, 1758	Spiny dogfish
Shark	Squalidae	*Squalus griffini* Phillipps, 1931	Northern spiny dogfish
Shark	Squalidae	*Squalus raoulensis* Duffy & Last, 2007	Kermadec spiny dogfish

Group	Family	Species	Common name
Shark	Squalidae	*Squalus* sp. 5	Green-eye dogfish
Shark	Centrophoridae	*Centrophorus harrissoni* McCulloch, 1915	Harrisson's dogfish
Shark	Centrophoridae	*Centrophorus squamosus* (Bonnaterre, 1788)	Leafscale gulper shark
Shark	Centrophoridae	*Deania calcea* (Lowe, 1839)	Shovelnose dogfish
Shark	Centrophoridae	*Deania histricosum* (Garman, 1906)	Rough longnose dogfish
Shark	Centrophoridae	*Deania quadrispinosum* (McCulloch, 1915)	Longsnout dogfish
Shark	Etmopteridae	*Centroscyllium* sp. cf. *kamoharai*	Fragile dogfish
Shark	Etmopteridae	*Etmopterus granulosus* (Günther, 1880)	Baxter’s dogfish
Shark	Etmopteridae	*Etmopterus lucifer* Jordan & Snyder, 1902	Lucifer's dogfish
Shark	Etmopteridae	*Etmopterus molleri* (Whitley, 1939)	Moller’s lantern shark
Shark	Etmopteridae	*Etmopterus pusillus* (Lowe, 1839)	Smooth lantern shark
Shark	Etmopteridae	*Etmopterus* cf. *unicolor*	Bristled lantern shark
Shark	Etmopteridae	*Etmopterus viator* Straube 2012	Blue-eye lantern shark
Shark	Somniosidae	*Centroscymnus coelolepis* Bocage & Capello, 1864	Portuguese dogfish
Shark	Somniosidae	*Centroscymnus owstonii* Garman, 1906	Owston’s dogfish
Shark	Somniosidae	*Centroselachus crepidater* (Bocage & Capello, 1864)	Longnose velvet dogfish
Shark	Somniosidae	*Proscymnodon plunketi* (Waite, 1909)	Plunket’s shark
Shark	Somniosidae	*Scymnodalatias albicauda* Taniuchi & Garrick, 1986	Whitetail dogfish
Shark	Somniosidae	*Scymnodalatias sherwoodi* (Archey, 1921)	Sherwood’s dogfish
Shark	Somniosidae	*Scymnodon* cf. *ringens* Bocage & Capello, 1864	Knifetooth dogfish
Shark	Somniosidae	*Somniosus antarcticus* Whitley, 1939	Southern sleeper shark
Shark	Somniosidae	*Somniosus longus* (Tanaka, 1912)	Little sleeper shark
Shark	Somniosidae	*Zameus squamulosus* (Günther, 1877)	Velvet dogfish
Shark	Oxynotidae	*Oxynotus bruniensis* (Ogilby, 1893)	Prickly dogfish
Shark	Dalatiidae	*Dalatias licha* (Bonnaterre, 1788)	Seal shark, black shark
Shark	Dalatiidae	*Euprotomicrus bispinatus* (Quoy & Gaimard, 1824)	Pygmy shark
Shark	Dalatiidae	*Isistius brasiliensis* (Quoy & Gaimard, 1824)	Cookie cutter shark

Group	Family	Species	Common name
Shark	Heterodontidae	*Heterodontus portusjacksoni* (Meyer, 1793)	Port Jackson shark
Shark	Rhincodontidae	*Rhincodon typus* (Smith, 1828)	Whale shark
Shark	Odontaspidae	*Odontaspis ferox* (Risso, 1810)	Deepwater (smalltooth) sand tiger shark
Shark	Pseudocarchariidae	*Pseudocarcharias kamoharai* (Matsubara, 1936)	Crocodile shark.
Shark	Mitsukurinidae	*Mitsukurina owstoni* Jordan, 1898	Goblin shark
Shark	Alopiidae	*Alopias superciliosus* (Lowe, 1839)	Bigeye thresher
Shark	Alopiidae	*Alopias vulpinus* (Bonnaterre, 1788)	Thresher shark
Shark	Cetorhinidae	*Cetorhinus maximus* (Gunnerus, 1765)	Basking shark
Shark	Lamnidae	*Carcharodon carcharias* (Linnaeus, 1758)	White shark, white pointer
Shark	Lamnidae	*Isurus oxyrinchus* Rafinesque, 1810	Mako shark, shortfin mako
Shark	Lamnidae	*Lamna nasus* (Bonnaterre, 1788)	Porbeagle shark
Shark	Scyliorhinidae	*Apristurus ampliceps* Sasahara, Sato & Nakaya 2008	Roughskin cat shark
Shark	Scyliorhinidae	*Apristurus* cf. *australis Sato, Nakaya & Yorozu 2008*	Pinocchio cat shark
Shark	Scyliorhinidae	*Apristurus exsanguis* Sato, Nakaya and Stewart 1999	Pale catshark
Shark	Scyliorhinidae	*Apristurus melanoasper* Iglésias, Nakaya & Stehmann 2004	Fleshynose cat shark
Shark	Scyliorhinidae	*Apristurus pinguis* Deng, Xiong & Zhan 1983	Cat shark
Shark	Scyliorhinidae	*Apristurus sinensis* Chu & Hu 1981	Freckled cat shark
Shark	Scyliorhinidae	*Apristurus* sp.	Cat shark
Shark	Scyliorhinidae	*Bythaelurus dawsoni* (Springer, 1971)	Dawson's cat shark
Shark	Scyliorhinidae	*Cephaloscyllium isabellum* (Bonnaterre, 1788)	Carpet shark
Shark	Scyliorhinidae	*Cephaloscyllium* sp.	Swellshark
Shark	Scyliorhinidae	*Parmaturus bigus* Seret & Last, 2007	Shorttail cat shark
Shark	Scyliorhinidae	*Parmaturus macmillani* Hardy, 1985	McMillan’s cat shark
Shark	Scyliorhinidae	*Parmaturus* sp.	Rough-backed cat shark
Shark	Scyliorhinidae	*Parmaturus* sp.	
Shark	Pseudotriakidae	*Gollum attenuatus* (Garrick, 1954)	Slender smooth hound
Shark	Pseudotriakidae	*Pseudotriakis microdon* Capello, 1868	False cat shark

Group	Family	Species	Common name
Shark	Triakidae	*Galeorhinus galeus* (Linnaeus, 1758)	School shark, tope
Shark	Triakidae	*Mustelus lenticulatus* Phillipps, 1932	Rig
Shark	Triakidae	*Mustelus* sp.	Kermadec Rig
Shark	Carcharhinidae	*Carcharhinus brachyurus* (Günther, 1870)	Bronze whaler
Shark	Carcharhinidae	*Carcharhinus falciformis* (Bibron in Muller & Henle, 1839)	Silky shark
Shark	Carcharhinidae	*Carcharhinus galapagensis* (Snodgrass & Heller, 1905)	Galapagos shark
Shark	Carcharhinidae	*Carcharhinus longimanus* (Poey, 1861)	Oceanic whitetip shark
Shark	Carcharhinidae	*Carcharhinus obscurus* (Le Sueur, 1818)	Dusky shark
Shark	Carcharhinidae	*Galeocerdo cuvier* (Peron & Le Sueur, 1822)	Tiger shark
Shark	Carcharhinidae	*Prionace glauca* (Linnaeus, 1758)	Blue shark
Shark	Sphyrnidae	*Sphyrna zygaena* (Linnaeus, 1758)	Hammerhead shark, smooth hammerhead
Batoid	Narkidae	*Typhlonarke aysoni* (Hamilton, 1902)	Blind electric ray
Batoid	Narkidae	*Typhlonarke tarakea* Phillipps, 1929	Oval electric ray
Batoid	Torpedinidae	*Torpedo fairchildi* Hutton, 1872	Electric ray
Batoid	Arhynchobatidae	*Arhynchobatis asperrimus* Waite, 1909	Longtail skate
Batoid	Arhynchobatidae	*Bathyraja richardsoni* (Garrick, 1961)	Richardson’s skate
Batoid	Arhynchobatidae	*Bathyraja shuntovi* Dolganov, 1985	Longnose deepsea skate
Batoid	Arhynchobatidae	*Bathyraja* sp.	Blonde skate
Batoid	Arhynchobatidae	*Brochiraja albilabiata* Last & McEachran, 2006	
Batoid	Arhynchobatidae	*Brochiraja asperula* (Garrick & Paul, 1974)	Smooth deepsea skate
Batoid	Arhynchobatidae	*Brochiraja leviveneta* Last & McEachran, 2006	
Batoid	Arhynchobatidae	*Brochiraja microspinifera* Last & McEachran, 2006	
Batoid	Arhynchobatidae	*Brochiraja spinifera* (Garrick & Paul, 1974)	Prickly deepsea skate
Batoid	Arhynchobatidae	*Notoraja sapphira* Seret & Last 2009	Sapphire skate
Batoid	Arhynchobatidae	*Notoraja* [subgenus C] sp. A [Last & McEachran]	
Batoid	Arhynchobatidae	*Notoraja* [subgenus C] sp. B [Last & McEachran]	
Batoid	Arhynchobatidae	*Notoraja* [subgenus C] sp. C [Last & McEachran]	

Group	Family	Species	Common name
Batoid	Arhynchobatidae	*Notoraja* [subgenus D] sp. A [Last & McEachran]	
Batoid	Rajidae	*Amblyraja* cf. *hyperborea* (Collette, 1879)	Arctic skate
Batoid	Rajidae	*Dipturus innominatus* (Garrick & Paul, 1974)	Smooth skate
Batoid	Rajidae	*Zearaja nasuta* (Banks in Müller & Henle, 1841)	Rough skate
Batoid	Dasyatidae	*Dasyatis brevicaudata* (Hutton, 1875)	Shorttail stingray
Batoid	Dasyatidae	*Dasyatis thetidis* Ogilby in Waite, 1899	Longtail stingray
Batoid	Dasyatidae	*Pteroplatytrygon violacea* (Bonaparte, 1832)	Pelagic stingray
Batoid	Myliobatidae	*Myliobatis tenuicaudatus* Hector, 1877	Eagle ray
Batoid	Mobulidae	*Manta birostris* (Donndorff, 1798)	Manta ray
Batoid	Mobulidae	*Mobula japanica* (Müller & Henle, 1841)	Spinetail devilray