

PELAGIC FISHERIES

PROPOSED PROJECTS FOR 2005/2006

<u>Code</u>	<u>Title</u>	<u>Priority</u>
ALB2005/01	Stock monitoring of albacore	High
EMA2005/01	Development of fisheries dependent indices of abundance for blue mackerel	High
EMA2005/02	Investigation of blue mackerel ageing error	High
JMA2005/01	Status of <i>Trachurus symmetricus murphyi</i> in New Zealand fisheries waters	Medium
KAH2005/01	Stock assessment of kahawai	High
KAH2005/02	Stock monitoring of kahawai – recreational catch	High
KAH2005/03	Stock monitoring of kahawai – commercial catch	High
PEL2005/01	Characterisation of pelagic fisheries using observer data	High
STM2005/01	Stock monitoring of striped marlin	High
TRE2005/01	Stock monitoring of trevally	High
TUN2005/01	Characterisation of the New Zealand tuna fisheries	High
TUN2005/02	Development of a commercial catch sampling programme for highly migratory species	High
OBS2005/05	Research Observer Services – Pelagic Fisheries	High

Project: Stock monitoring of albacore

Project Code: ALB2005/01

Start Date: 1 October 2005

Completion Date: 30 September 2008

Vessel Use: None

Overall Objectives:

1. To determine the length composition of the commercial catch of albacore (*Thunnus alalunga*) in New Zealand fisheries waters.
2. To support the stock assessment of the wider South Pacific albacore stock.

Specific Objectives:

1. To conduct sampling in fish sheds and determine and report the length composition and length-weight relationships of albacore tuna during the 2005/2006 fishing year from samples collected in fish sheds. The target coefficient of variation (c.v.) for the length composition is 20 % (mean weighted c.v. across all length classes).
2. To conduct sampling in fish sheds and determine and report the length composition and length-weight relationships of albacore tuna during the 2006/2007 fishing year from samples collected in fish sheds. The target coefficient of variation (c.v.) for the length composition is 20 % (mean weighted c.v. across all length classes).
3. To conduct sampling in fish sheds and determine and report the length composition and length-weight relationships of albacore tuna during the 2007/2008 fishing year from samples collected in fish sheds. The target coefficient of variation (c.v.) for the length composition is 20 % (mean weighted c.v. across all length classes).
4. To collect 50 pairs of otoliths from fish of 50 cm fork length or less per fishing year.

Note:

This is a multi-year project and the second and third years of monitoring will be reviewed when Stock Strategies or Fisheries Plans that include albacore are developed.

As the season for albacore is generally finished by May, completion of this project by the end of the fishing year is achievable. The current project ALB2003/01 *Stock monitoring of albacore* finishes in September 2005.

No otoliths will be aged in this project and the otoliths collected will be forwarded to the Oceanic Fisheries Programme of the SPC.

Rationale:

General

Albacore tuna caught in New Zealand fisheries waters are part of a single South Pacific Ocean stock that ranges from the equator to about 45° S. Recent annual catches from the South Pacific stock have ranged between 25,000 and 40,000 t; about 75 % of which is caught by longline vessels with the rest taken mainly by trolling.

The New Zealand fishery is predominantly a summer fishery in which over 95% of landings occur before May. Trolling is the main method used by domestic fishers (about 80 %) followed by longlining (20 %). 6574 t of albacore were landed in 2002/03. The troll fishery is an important component of the annual fishing plan of several inshore fishers targeting a wide range of species with different gear types throughout the year. The albacore catch is an important and stable component of the tuna longline fishery.

Although the regional stock assessment model results are uncertain, exploitation rates are considered moderate and current catches are likely to be sustainable in the medium term. Assessments conducted with limited data on stocks such as South Pacific albacore that, apparently, have been subject to low exploitation rates provide little information on the biomass of the stock. The 2003 assessment gave similar results to the 2002 assessment, with a low impact of fishing on biomass, and indicated that the current biomass is at about 60% of unfished levels. Current catch levels from the South Pacific albacore stock appear likely to maintain the albacore stock at a size capable of supporting an MSY.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Albacore are currently outside the QMS. In the absence of a Fisheries Plan for albacore, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of albacore stocks in relation to the B_{MSY} as estimated in a regional context.

A stock assessment of albacore specifically for New Zealand fisheries waters is not currently possible as the proportion of the South Pacific stock that migrates through and/or resides in New Zealand fisheries waters is unknown.

Changes to the population structure, such as a pronounced reduction in catches of larger fish, or the absence of small fish are the types of signals that might indicate that the albacore stock is under pressure. A time-series of annual size structures will provide a means by which the Ministry can monitor the status of the albacore stock; and, possibly in the future, monitor the effects of management changes. In the absence of a formal stock assessment for New Zealand fisheries waters, monitoring is based on an annual catch sampling programme.

Size structure of the New Zealand albacore catch was considered to be a critical input to the regional size structured stock assessment at the most recent Standing Committee on Tuna and Billfish meeting when it reviewed the albacore stock status. There is a risk that if this particular research project is not undertaken, the current South Pacific albacore stock assessment will be less reliable.

This research is necessary because:

- South Pacific stock status is uncertain and the impact of large catches of juvenile and sub-adult fish in New Zealand waters on the stock are unknown;
- Annual catch sampling is currently our only monitoring tool for this stock;
- The project has been identified as integral to the albacore component of the New Zealand Pelagic Fisheries Medium Term Research Plan;
- A time series of data are required for stock assessment purposes; and
- The data are an important input to the regional stock assessment.

Within this context, this research project is considered a high priority.

Objectives 1, 2, 3 and 4

Under these objectives, the sampling in fish sheds and determination of the length composition and length-weight relationships of albacore tuna during the 2005/2006, 2006/07, 2007/08 fishing years will occur. Sampling will occur in fish sheds at Onehunga, Greymouth, and New Plymouth throughout the albacore troll season. The target coefficient of variation (c.v.) for the length composition is 20 % (mean weighted c.v. across all length classes).

All fish should be measured for length with a sub-sample measured for weight.

An additional requirement is to collect 50 pairs of otoliths from albacore of 50 cm fork length or less in each year. These will need to be catalogued into the Ministry of Fisheries archive, and then forwarded to the Oceanic Fisheries Programme of the SPC for a regional project.

Additional information on sampling methodologies for this project can be obtained from the outputs of TUN2001/02.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (1) (a) of the Fisheries (Cost Recovery) Rules 2001:

- ALB.

The project is estimated to cost between \$150,000 - \$200,000.

Project: Development of fisheries dependent indices of abundance for blue mackerel

Project Code: EMA2005/01

Start Date: 1 July 2005

Completion Date: 30 June 2006

Vessel Use: None

Overall Objectives:

1. To develop fisheries dependent indices of relative abundance for use in stock assessment of blue mackerel.

Specific Objectives:

1. To develop a fisheries dependent relative index, or set of indices, of abundance for blue mackerel up to the end of the 2003/2004 fishing year, and if possible up to the end of the 2004/2005 fishing year, for use in stock assessment.

Rationale:

General

Blue mackerel support a moderate volume fishery with catches exceeding 10 000 t in four of the past five years. More recently, commercial landings of over 13 000 t were taken in 1998–99 and 2000–01, with the highest catches recorded in EMA 1 and EMA 7. The largest and most consistent catches have been from the target purse-seine fishery in EMA 1, 2 and 7, and as non-target catch in the jack mackerel midwater trawl fishery in EMA 7. Most of the purse seine catch comes from the Bay of Plenty and East Northland, where it is primarily taken between July and December.

Blue mackerel does not rate highly as a recreational target species although it is popular as bait. No quantitative information on the level of Māori customary fishing is available. Recreational and customary catches are assumed small in the context of overall stock removals.

Little is known about the status of blue mackerel stocks. No estimates of current and reference biomass, or yield, are available for blue mackerel. It is not known if recent catch levels are sustainable or at levels that will allow the stock to move towards a size that will support the MSY.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Blue mackerel were introduced into the QMS in October 2002. In the absence of a Fisheries Plan for any of the blue mackerel Fishstocks, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of the blue mackerel stocks in relation to the B_{MSY} .

A stock assessment and subsequent determination of the status of the stock in relation to the B_{MSY} is not possible at this time, but is currently scheduled for 2006/07 in the New Zealand Pelagic Fisheries Medium Term Research Plan and this project, in combination with recent research on blue mackerel, will provide a sound basis for a future stock assessment. In the absence of a formal stock assessment, monitoring of the stock is based on catch sampling, evaluation of fishery-dependent abundance indices, and comparing landings with TAC.

This research is necessary because:

- Stock status of blue mackerel is currently unknown;
- Fishery-dependent abundance indices for blue mackerel will be a key input for the stock assessment proposed for 2006/07;
- The project has been identified as integral to the blue mackerel component of the New Zealand Pelagic Fisheries Medium Term Research Plan; and
- If this project does not go ahead, the future stock assessments for blue mackerel will be delayed.

Within this context, this research project is considered a high priority.

Objective 1

The various potential relative and other indices should be considered individually and collectively for the assessment. Potential opportunities exist for aerial sightings data (with data back to 1975) and CPUE from target (e.g., EMA 7 target trawl fishery) or bycatch (e.g., JMA 7 target trawl fishery) fisheries. A standardised index of abundance from aerial sightings in EMA 1 has previously been partially developed. It needs further development if it is to be used for stock assessment.

Factors other than EMA abundance could play an important role in CPUE, e.g. market influences and/or the abundance of other species. These factors should be considered in an analysis of fishery-dependent data. EMA2004-01 included objectives that involved describing the influence of market forces on the various EMA fisheries.

The outputs should include an index or set of indices, and a clearly justified set of recommendations on a programme for improving the index, or indices, in future.

Additional information on blue mackerel for this project can be obtained from the outputs of EMA2002/01, EMA2004/01, PEL2001/01 and NZFAR2001/44.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- EMA1, EMA 2, EMA 3 and EMA 7.

The project is estimated to cost between \$50,000 - \$100,000.

Project: Investigation of blue mackerel ageing error

Project Code: EMA2005/02

Start Date: 1 October 2005

Completion Date: 30 September 2006

Vessel Use: None

Overall Objectives:

1. To investigate the impact of ageing error in the development of catch-at-age from the blue mackerel catch sampling programme.

Specific Objectives:

1. To investigate the impact of ageing error in the development of catch-at-age from the blue mackerel catch sampling programme for the purpose of stock assessment.
2. To review and refine protocols for ageing blue mackerel otoliths.
3. To validate age estimates for blue mackerel.

Note:

Specific Objective 2 is contingent on recommendations from the Pelagic Fisheries Stock Assessment Working Group after reviewing results from EMA2003/01.

Rationale:

General

Blue mackerel support a moderate volume fishery with catches exceeding 10 000 t in four of the past five years. More recently, commercial landings of over 13 000 t were taken in 1998–99 and 2000–01, with the highest catches recorded in EMA 1 and EMA 7. The largest and most consistent catches have been from the target purse-seine fishery in EMA 1, 2 and 7, and as non-target catch in the jack mackerel midwater trawl fishery in EMA 7. Most of the purse seine catch comes from the Bay of Plenty and East Northland, where it is primarily taken between July and December.

Blue mackerel does not rate highly as a recreational target species although it is popular as bait. No quantitative information on the level of Māori customary fishing is available. Recreational and customary catches are assumed small in the context of overall stock removals.

Little is known about the status of blue mackerel stocks. No estimates of current and reference biomass, or yield, are available for blue mackerel. It is not known if recent catch levels are sustainable or at levels that will allow the stock to move towards a size that will support the MSY.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Blue mackerel were introduced into the QMS in October 2002. In the absence of a Fisheries Plan for any of the blue mackerel Fishstocks, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of the blue mackerel stocks in relation to the B_{MSY} .

The most recent catch sampling for blue mackerel suggest ageing error may be blurring our ability to detect the presence of strong year classes in the programme and consequently impacting on our ability to conduct a robust stock assessment in future. A stock assessment and subsequent determination of the status of the stock in relation to the B_{MSY} is not possible at this time, but is currently scheduled for 2006/07 in the New Zealand Pelagic Fisheries Medium Term Research Plan and this project, in combination with recent research on blue mackerel, will provide a sound basis for a future stock assessment. In the absence of a formal stock assessment, monitoring of the stock is based on catch sampling, evaluation of fishery-dependent abundance indices, and comparing landings with TAC.

This research is necessary because:

- Stock status of blue mackerel is currently unknown;
- Our ability to quantify and/or overcome problems encountered in the ageing of blue mackerel are critical for decisions about future research for blue mackerel, in particular catch sampling and stock assessment methods;
- The project has been identified as integral to the blue mackerel component of the New Zealand Pelagic Fisheries Medium Term Research Plan; and
- If this project does not go ahead, catch sampling programmes will not be changed to provide improved data for assessing and monitoring blue mackerel and appropriate methods for the future stock assessments for blue mackerel may not be considered.

Within this context, this research project is considered a high priority.

Objective 1

The methods used for future catch monitoring and stock assessments for blue mackerel will depend heavily on our ability to accurately and cost effectively age samples from the catch. We have only limited experience ageing blue mackerel otoliths and furthermore blue mackerel are considered as hard-to-read. This objective will involve a desktop simulation study to assess the extent of the ageing error problem and its possible impact on stock monitoring and assessment approaches.

The output from this objective will be recommendations for any required optimisation of the existing catch sampling programme.

Also included should be recommendations for future stock assessment methodologies based on the types of data that can reliably be obtained through catch monitoring. Ageing error matrices should also be constructed under this objective.

Objective 2

As noted above, New Zealand has only recently developed methods to estimate New Zealand blue mackerel ages. This method involves counting fully formed opaque zones in sagittal otolith thin sections under transmitted light. This method was used to estimate the age composition of the EMA 1 purse seine catch during 2002–03.

Initial results indicated that between-reader precision was moderate, and that there were some systematic differences in interpretation. Currently samples are being aged under project EMA2003/01. If this project indicates a worsening of between-reader precision estimates or further systematic differences in interpretation, it will be necessary to review and further develop reading protocols.

The output of this objective will be revised reading protocols for blue mackerel otoliths that will address between-reader precision estimates or systematic differences in interpretation.

Objective 3

Validation is a critical part of any fish ageing programme and currently the age estimates for blue mackerel are not validated. There are a range of techniques that can be used to validate age estimates, but some of these are likely to be too expensive for a low to moderate value fishery like blue mackerel.

It is noted that chemical marking experiments are often expensive and no archival otolith collection exists to allow radioisotope methods to be applied. While less powerful, a “marginal state” analysis, where otoliths collected throughout the year are analysed, could provide a cost-effective approach to validate blue mackerel otolith ageing.

Under this objective, a cost effective validation procedure will be developed for blue mackerel.

Additional information on blue mackerel ageing and blue mackerel ageing error issues can be obtained from the outputs of EMA2002/01 and NZFAR2001/44.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- EMA 1, EMA 2, EMA 3 and EMA 7.

The project is estimated to cost between \$50,000 - \$100,000.

Project: Status of *Trachurus symmetricus murphyi* in New Zealand fisheries waters

Project Code: JMA2005/01

Start Date: 1 October 2005

Completion Date: 30 April 2007

Vessel Use: None

Overall Objectives:

1. To determine the relative abundance and population structure of *T. s. murphyi* in New Zealand fisheries waters.

Specific Objectives:

1. To review and summarise existing data describing the abundance and distribution of *T. s. murphyi* in New Zealand fisheries waters, in particular patterns of significant change in spatial distribution since the mid 1980s.
2. To analyse otoliths collected from observers and other sources to estimate annual age compositions for *T. s. murphyi* in New Zealand fisheries waters.

Rationale:

General

The New Zealand jack mackerel fisheries catch three species, the two New Zealand species, *Trachurus declivis* and *T. novaezelandiae*, and the more recently arrived *T. s. murphyi* (the Peruvian jack mackerel). *T. s. murphyi* spread into New Zealand fisheries waters in the early 1980s and is now the dominant species in some areas.

The three species of jack mackerel support substantial commercial trawl and purse seine fisheries, with landings from 1991/92 to 1994/95 ranging between 38,000 t and 48,000 t. In 2001/2002 landings totalled 32,585 t with JMA 3 accounting for 5,000 t, JMA 7 for 22,338 t and JMA 1 for 5,247 t.

Jack mackerel does not rate highly as a recreational target species although it is popular as bait. JMA 1 is the major recreational fishery for jack mackerels with around 100 t being taken annually. No quantitative information on the level of Māori customary fishing is available. Recreational and customary catches are assumed small in the context of overall stock removals.

The size of the jack mackerel resource in JMA 1 is unknown, although aerial sighting data from 1976 to 1993 suggest no change in abundance until the early 1990s when an increase may have occurred. The resource in JMA 3 has increased in recent years but few stock assessment data are available. In JMA 1 and JMA 3 landings have generally increased since the 1980s, probably caused by the increased availability of *T. s. murphyi*.

It is not known whether catches at the level of the current TACCs or recent catch levels are sustainable in the long term for these areas. For JMA 7, the current TACC and recent landings are considered to be sustainable.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Jack mackerels were partially introduced into the QMS 1984 with full introduction in 1996. In the absence of a Fisheries Plan for any of the jack mackerel Fishstocks, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of the jack mackerel stocks in relation to the B_{MSY} .

Increased availability of jack mackerels caused by the invading *T. s. murphyi* resulted in increased quotas in JMA 1 and JMA 3 under the proviso that they be accounted for by increased catches of *T. s. murphyi* only. Industry agreed to these limits and voluntarily introduced monitoring programmes to provide the information necessary for them to be met.

A stock assessment and subsequent determination of the status of the stock in relation to the B_{MSY} is not possible at this time, but stock assessments for the two endemic species are currently being undertaken and a stock assessment of *T. s. murphyi* is currently scheduled for 2006/07 in the New Zealand Pelagic Fisheries Medium Term Research Plan. In the absence of a formal stock assessment, monitoring of the stock is based on comparing landings against the TAC.

Given the impact that the invasion of *T. s. murphyi* has had on the jack mackerel fisheries and management actions related to this invasion, an analysis of the current status and likely sustainability of this population within New Zealand fisheries waters is important.

This research is necessary because:

- Stock status of jack mackerels are currently poorly known;
- Catch limits were increased for jack mackerel in several regions based on increased abundance associated with the invasion of *T. s. murphyi* and the current status of *T. s. murphyi* is poorly known, though considerable data is now available for analysis;
- The output from this project will be important input for the stock assessment for *T. s. murphyi* scheduled for 2006/07 in the New Zealand Pelagic Fisheries Medium Term Research Plan; and
- If this project does not go ahead, it will not be possible to determine if the increased catch limits for jack mackerel are still appropriate, however, stock assessments for the two endemic species are currently being undertaken and should provide information on appropriate catch levels for these species.

Within this context, this research project is considered a medium priority.

Objective 1

While it might not be possible to determine the exact status of *T. s. murphyi* within New Zealand fisheries waters, considerable data exists from commercial fisheries and research surveys to examine the spatial and temporal distribution of *T. s. murphyi* within New Zealand fisheries waters since the original invasion. These data should be examined to provide details of the distribution (and relative abundance if possible) of *T. s. murphyi* within New Zealand fisheries waters and how this may have changed over time. This will include examination of the target JMA fisheries to separate fishery and natural effects, e.g., have fishing practices changed over time and how do catches relate to likely abundance.

The output from this project will be descriptions of the spatial and temporal distribution of *T. s. murphyi* within New Zealand fisheries waters and possibly abundance indices from commercial CPUE or research surveys if these are seen to be appropriate indices of abundance.

Objective 2

Information on the age composition could provide additional information on the status of *T. s. murphyi* within New Zealand fisheries waters. Of particular interest will be the number of cohorts found in an area/time strata and whether new cohorts have appeared in the samples since the original invasion. Scientific observers have collected otoliths and otoliths have also been collected during research surveys.

A considerable number of otoliths are available for analysis, but there is variation in the numbers available each year. Over the period 1993 to 2000, scientific observers collected 788 otoliths. No otoliths were collected in 2001 and 2002, but up to 100 have been collected in 2004. Prior to 1993, up to 500 otoliths were collected but most of these are still in envelopes and have not been catalogued.

The output from this objective will be estimates of the age composition in different regions and how the distribution of age classes has varied over time since the invasion. The target coefficient of variation (c.v.) for the catch at age will be 30% (mean weighted c.v. across all age classes). It is recognised, however, that rather than a standard catch at age exercise, the goal of Objective 2 is to use the age data to provide insights into the status of *T. s. murphyi* in New Zealand waters. The key determinate will likely be the number of cohorts represented in the catches – this information will provide details on the status of *T. s. murphyi*, but is also the key factor in determining the number of otoliths to be aged.

In combination with Objective 1, this project will provide hypotheses on the status of *T. s. murphyi* within New Zealand fisheries waters, including discussion of the possible implications of different hypotheses for both future stock assessment and management.

Additional information on the status of *T. s. murphyi* in New Zealand waters and the ageing of *T. s. murphyi* can be obtained from the outputs of JMA2000/02, JMA2001/01, NZFAR2002/21 and NZFAR2004/28.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- JMA 1, JMA 3 and JMA 7.

The project is estimated to cost between \$100,000 - \$150,000.

Project: Stock assessment of kahawai

Project Code: KAH2005/01

Start Date: 1 July 2005

Completion Date: 30 June 2007

Vessel Use: None

Overall Objectives:

1. To conduct a stock assessment for kahawai (*Arripis trutta* and *Arripis xylabion*), including estimating biomass and sustainable yields.

Specific Objectives:

1. To develop abundance indices for important kahawai fisheries.
2. To develop a stock assessment model for kahawai in New Zealand fisheries waters that allows estimation of biomass and sustainable yields and takes account of spatial considerations.
3. To conduct a stock assessment, including estimating biomass and sustainable yields for kahawai in New Zealand fisheries waters.

Note:

This project will begin in 2005, but will not be complete until mid 2007. The extended duration of the project is intended to allow development of a new stock assessment and incorporation of additional new data that will not be available until late 2006.

The feasibility and scope for Specific Objectives 2 and 3 are dependent on the success in developing abundance indices in Specific Objective 1.

Rationale:

General

Kahawai supports important commercial, recreational, and Māori customary fisheries, but estimates of the current status of the kahawai stocks are uncertain as a stock assessment for kahawai has not been conducted since 1995-96.

The total commercial catch in 2002/03 was 3001 t (the 1996/97 catch of 3757 t had a landed value in excess of \$ 1.5 million). Commercial fishers take kahawai by a variety of methods (purse seine, trawl, and set net); however, purse seine vessels take most of the catch. The majority of the commercial catches for kahawai come from KAH 1, 2, and 3, with catches in the most recent year similar across areas.

Kahawai is a popular recreational species and is prized for its fighting qualities. Recreational fishing surveys do not distinguish between the two kahawai species. Estimates of recreational catch are uncertain, and particularly in KAH 1, KAH 2 and KAH 8 this uncertainty is likely to severely impact on the ability to assess stock status.

Although uncertain, recreational catches of kahawai are considered significant in the context of the overall stock removals, and may be more than 50% of the total removals in some areas.

Kahawai is an important traditional food fish for Māori. There is very little information available to allow estimation of the amount of kahawai taken in the traditional Māori fishery, but catches are assumed moderate in the context of the overall stock removals.

There are no current estimates of the status of kahawai stocks. The most recent stock assessment for kahawai was undertaken in 1995 using a stock reduction model. Estimates of biomass and yield from that analysis were uncertain but appear to be conservative. Biomass was estimated in 1996 to be well above the size that would support the MSY. Mortality estimates at that time indicated that levels of fishing for kahawai were equal to or less than natural mortality. Levels of fishing mortality near or below natural mortality are generally considered sustainable. There is a perception, widely held by the recreational sector, that kahawai schools are becoming fewer and the fish smaller in size; Māori too have expressed concern over an apparent decline in the abundance of kahawai.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Kahawai were introduced into the QMS in October 2004. In the absence of a Fisheries Plan for any of the kahawai Fishstocks, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of the kahawai stocks in relation to the B_{MSY} . The Minister's letter to stakeholders regarding the introduction of kahawai into the QMS noted that there was an agreement of sector groups for managing kahawai stocks above B_{MSY} .

The status of kahawai stocks was last assessed in 1995 using a stock reduction model. Estimates of biomass and yield from that analysis were uncertain but appear to be conservative. Since this time, monitoring of the status of the stocks has been based on comparing catches against commercial catch limits and annual sampling the sizes and ages of fish taken in the recreational fishery.

At the time of the 1995 assessment, there was considerable uncertainty in many of the model inputs. Now, many of these issues can be better addressed and a range of important data, essential for a stock assessment, are now being collected and time series are available, e.g., catch monitoring and CPUE for recreational catches. While, there are still some outstanding issues, in particular stock structure and recreational catch estimates, it is not necessary to delay the assessment until these can be resolved; rather uncertainty in these model inputs and structures can be assessed within the modelling framework. This approach will indicate the areas of greatest uncertainty to estimating abundance and sustainable yields and thus the directions of future research.

This research is necessary because:

- Kahawai supports valuable commercial, recreational, and customary fisheries;
- Stock status of kahawai is currently unknown, the last stock assessment was undertaken in 1995;
- A stock assessment is necessary to determine if the current levels of removals will allow the stock to move towards a level that will support the maximum sustainable;
- The project has been identified as integral to the kahawai component of the New Zealand Pelagic Fisheries Medium Term Research Plan; and
- If this project does not go ahead, we can not determine if the current levels of removals will allow the stock to move towards a level that will support the maximum sustainable.

Within this context, this research project is considered a high priority.

Objective 1

One output of project KAH 2004/01 will be recommendations of abundance indices for use in the stock assessment of kahawai. Options could include aerial sightings, recreational CPUE, and CPUE for components of the commercial fishery. Based on these recommendations, an abundance index (or abundance indices) should be calculated based for the available data series.

Objectives 2 and 3

There have been several years since the last assessment and many of the types of data necessary for an assessment are now available. Historical and concurrent research projects provide information of recreational harvest estimates, abundance indices, and catch composition for important fishing components.

There are a number of important issues that will be considered in the development of a stock assessment model for kahawai. In many instances (e.g., stock structure) there may not be reliable information to determine the most likely scenario so the modelling framework will require the flexibility to examine a range of options. Historic data should be utilised to explore stock structure hypothesis. Any modelling approach should be able to allow for examination of stock structure hypotheses and appropriate spatial modelling of abundance indices.

As there is considerable uncertainty in some important data inputs (e.g. recreational harvest estimates), the modelling approach should allow consideration of these and other uncertainties and indicate areas of greatest model uncertainty with a view for indicating future research directions.

Once developed, the stock assessment model should be used to undertake a full stock assessment for kahawai, including estimates of biomass and sustainable yields.

An updated assessment will likely be required in the near future, another output from the current project should be clearly identified research required to improve that next assessment.

The results from Project KAH2004/01 "Characterisation of the kahawai fisheries" will include summaries of some biological parameters necessary for the stock assessment and Projects KAH2005/02 and KAH2005/03 will provide age and length composition data for the catches of the recreational and commercial components of the fishery.

Project PEL2003/02 will provide a fishery dependent index of abundance from aerial sightings data. Project KAH2003/01 will provide a fishery dependent index of abundance from recreational catch per unit of effort data. Other data include historic juvenile recruitment and tag/recapture data. Results from new recreational harvest estimate work should be available and incorporated. Data from KAH2005/03 are expected to be initially guessed and then incorporated into the assessment as they become available.

A general timeframe for the project would see the model inputs and structure reviewed in PELWG meetings in October/November 2005, with revisions and a preliminary assessment would be undertaken between then and late February. The initial assessment would be reviewed in March 2006, and presented to the May 2006 plenary if considered appropriate by the Pelagic Fisheries Stock Assessment Working Group. As this assessment is being developed from scratch, presentation to the plenary is unlikely until 2007.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- KAH 1, KAH 2, KAH 3 and KAH 8.

The project is estimated to cost between \$150,000 - \$200,000.

Project: Stock monitoring of kahawai – recreational catches

Project Code: KAH2005/02

Start Date: 1 September 2005

Completion Date: 30 November 2006

Vessel Use: None

Overall Objectives:

1. To monitor the status of the kahawai (*Arripis trutta* and *Arripis xylabion*) stocks.

Specific Objectives:

1. To conduct the sampling and determine the length and age composition of the recreational landings of kahawai in KAH 1 for the 2005/06 fishing year. The target coefficient of variation (c.v.) for the catch at age will be 30% (mean weighted c.v. across all age classes).

Note:

The current project KAH2003/01 ‘Stock monitoring of kahawai’ includes the monitoring of recreational landings for 2003/04 and 2004/05 is due for completion in May 2006.

Rationale:

General

Kahawai supports important commercial, recreational, and Māori customary fisheries, but estimates of the current status of the kahawai stocks are uncertain as a stock assessment for kahawai has not been conducted since 1995-96.

The total commercial catch in 2002/03 was 3001 t (the 1996/97 catch of 3757 t had a landed value in excess of \$ 1.5 million). Commercial fishers take kahawai by a variety of methods (purse seine, trawl, and set net); however, purse seine vessels take most of the catch. The majority of the commercial catches for kahawai come from KAH 1, 2, and 3, with catches in the most recent year similar across areas.

Kahawai is a popular recreational species and is prized for its fighting qualities. Recreational fishing surveys do not distinguish between the two kahawai species. Estimates of recreational catch are uncertain, and particularly in KAH 1, KAH 2 and KAH 8 this uncertainty is likely to severely impact on the ability to assess stock status. Although uncertain, recreational catches of kahawai are considered significant in the context of the overall stock removals, and may be more than 50% of the total removals in some areas.

Kahawai is an important traditional food fish for Māori. There is very little information available to allow estimation of the amount of kahawai taken in the traditional Māori fishery, but catches are assumed moderate in the context of the overall stock removals.

There are no current estimates of the status of kahawai stocks. The most recent stock assessment for kahawai was undertaken in 1995 using a stock reduction model. Estimates of biomass and yield from that analysis were uncertain but appear to be conservative. Biomass was estimated in 1996 to be well above the size that would support the MSY. Mortality estimates at that time indicated that levels of fishing for kahawai were equal to or less than natural mortality. Levels of fishing mortality near or below natural mortality are generally considered sustainable. There is a perception, widely held by the recreational sector, that kahawai schools are becoming fewer and the fish smaller in size; Māori too have expressed concern over an apparent decline in the abundance of kahawai.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Kahawai were introduced into the QMS in October 2004. In the absence of a Fisheries Plan for any of the kahawai Fishstocks, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of the kahawai stocks in relation to the B_{MSY} . The Minister's letter to stakeholders regarding the introduction of kahawai into the QMS noted that there was an agreement of sector groups for managing kahawai stocks above B_{MSY} .

The status of kahawai stocks was last assessed in 1995 using a stock reduction model. Estimates of biomass and yield from that analysis were uncertain but appear to be conservative. Since this time, monitoring of the status of the stocks has been based on comparing catches against commercial catch limits and sampling the sizes and ages of fish taken in the recreational fishery.

At the time of the 1995 assessment, there was considerable uncertainty in many of the model inputs. Now, many of these issues can be better addressed and a range of important data, essential for a stock assessment, are now being collected and time series are available, e.g., catch monitoring and CPUE for recreational catches. While, there are still some outstanding issues, in particular stock structure and recreational catch estimates, it is not necessary to delay the assessment until these can be resolved; rather uncertainty in these model inputs and structures can be assessed within the modelling framework. This approach will indicate the areas of greatest uncertainty to estimating abundance and sustainable yields and thus the directions of future research.

This research is necessary because:

- Kahawai supports valuable commercial, recreational, and customary fisheries;
- Stock status is kahawai is currently unknown, the last stock assessment was undertaken in 1995;
- Sampling the recreational catch is considered a useful method for monitoring the entire kahawai stock status and a time series of these data have been developed. These data will also be a critical input for the stock assessment (KAH2005/01);
- The project has been identified as integral to the kahawai component of the New Zealand Pelagic Fisheries Medium Term Research Plan; and

- If this project does not go ahead, the reliability of the kahawai stock assessment will be greatly reduced.

Within this context, this research project is considered a high priority.

Objective 1

Catch sampling of the stocks to determine catch-at-age and catch-at-length time series data is one method of monitoring the kahawai stock status. However, such data are most useful when combined with abundance indices in the form of a stock assessment. The recreational catch consists of a broad range of size classes, while commercial catches are thought to include a lesser range of sizes. So while sampling the recreational catch is considered a useful method for monitoring the entire kahawai stock status, in the short-term it will be important to sample both recreational and commercial landings as these will be important in determining an range of stock assessment model options (e.g., selectivity curves for different fisheries).

It is proposed that recreational landings of kahawai in KAH 1 are monitored for a further year (2005/06) immediately following the existing programme. Interruptions in time series (i.e. between programmes) should be avoided, as it is difficult to detect low strength year classes when variability is high. A continuous time series however, results in multiple estimates of a year class's strength, making their identification more certain. This is especially important in the Hauraki Gulf and East Northland sub-stocks, which appear to be comprised of relatively few age classes.

The results and conclusions of the stock assessment modelling (KAH2005/01) will determine the future requirements for catch monitoring of recreational catches, in particular the periodicity of sampling.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- KAH 1, KAH 2, KAH 3 and KAH 8.

The project is estimated to cost between \$100,000 - \$150,000.

Project: Stock monitoring of kahawai – commercial catches

Project Code: KAH2005/03

Start Date: 1 July 2005

Completion Date: earliest possible in 2006

Vessel Use: None

Overall Objectives:

1. To monitor the status of the kahawai (*Arripis trutta* and *Arripis xylabion*) stocks.

Specific Objectives:

1. To conduct the sampling and determine the length and age composition of the commercial landings of kahawai in selected KAH areas for the 2005/06 fishing year. The target coefficient of variation (c.v.) for the catch at age will be 30% (mean weighted c.v. across all age classes).

Note:

The results from Project KAH2004/01 “Characterisation of the kahawai fisheries” should be considered in determining a catch-monitoring programme for commercial kahawai landings.

Areas of application (e.g. KAH 1, 2, and 3) will be determined by PELWG subject to review of the characterisation study.

Where possible synergies with other shed sampling programmes in the areas of interest will be created.

Rationale:

General

Kahawai supports important commercial, recreational, and Māori customary fisheries, but estimates of the current status of the kahawai stocks are uncertain as a stock assessment for kahawai has not been conducted since 1995-96.

The total commercial catch in 2002/03 was 3001 t (the 1996/97 catch of 3757 t had a landed value in excess of \$ 1.5 million). Commercial fishers take kahawai by a variety of methods (purse seine, trawl, and set net); however, purse seine vessels take most of the catch. The majority of the commercial catches for kahawai come from KAH 1, 2, and 3, with catches in the most recent year similar across areas.

Kahawai is a popular recreational species and is prized for its fighting qualities. Recreational fishing surveys do not distinguish between the two kahawai species. Estimates of recreational catch are uncertain, and particularly in KAH 1, KAH 2 and KAH 8 this uncertainty is likely to severely impact on the ability to assess stock status.

Although uncertain, recreational catches of kahawai are considered significant in the context of the overall stock removals, and may be more than 50% of the total removals in some areas.

Kahawai is an important traditional food fish for Māori. There is very little information available to allow estimation of the amount of kahawai taken in the traditional Māori fishery, but catches are assumed moderate in the context of the overall stock removals.

There are no current estimates of the status of kahawai stocks. The most recent stock assessment for kahawai was undertaken in 1995 using a stock reduction model. Estimates of biomass and yield from that analysis were uncertain but appear to be conservative. Biomass was estimated in 1996 to be well above the size that would support the MSY. Mortality estimates at that time indicated that levels of fishing for kahawai were equal to or less than natural mortality. Levels of fishing mortality near or below natural mortality are generally considered sustainable. There is a perception, widely held by the recreational sector, that kahawai schools are becoming fewer and the fish smaller in size; Māori too have expressed concern over an apparent decline in the abundance of kahawai.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Kahawai were introduced into the QMS in October 2004. In the absence of a Fisheries Plan for any of the kahawai Fishstocks, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of the kahawai stocks in relation to the B_{MSY} . The Minister's letter to stakeholders regarding the introduction of kahawai into the QMS noted that there was an agreement of sector groups for managing kahawai stocks above B_{MSY} .

The status of kahawai stocks was last assessed in 1995 using a stock reduction model. Estimates of biomass and yield from that analysis were uncertain but appear to be conservative. Since this time, monitoring of the status of the stocks has been based on comparing catches against commercial catch limits and sampling the sizes and ages of fish taken in the recreational fishery.

At the time of the 1995 assessment, there was considerable uncertainty in many of the model inputs. Now, many of these issues can be better addressed and a range of important data, essential for a stock assessment, are now being collected and time series are available, e.g., catch monitoring and CPUE for recreational catches. While, there are still some outstanding issues, in particular stock structure and recreational catch estimates, it is not necessary to delay the assessment until these can be resolved; rather uncertainty in these model inputs and structures can be assessed within the modelling framework. This approach will indicate the areas of greatest uncertainty to estimating abundance and sustainable yields and thus the directions of future research.

This research is necessary because:

- Kahawai supports valuable commercial, recreational, and customary fisheries;
- Stock status is kahawai is currently unknown, the last stock assessment was undertaken in 1995;

- Sampling the commercial catch will be important for determining the sizes of fish taken and these fisheries and will provide important information on the selectivity of these fisheries for the stock assessment (KAH2005/01);
- The project has been identified as integral to the kahawai component of the New Zealand Pelagic Fisheries Medium Term Research Plan; and
- If this project does not go ahead, the reliability of the kahawai stock assessment will be greatly reduced.

Within this context, this research project is considered a high priority.

Objective 1

It is proposed that commercial landings of kahawai in KAH 1 are monitored for the year 2005/06. The results from Project KAH2004/01 “Characterisation of the kahawai fisheries” should be considered in determining a catch-monitoring programme for commercial kahawai landings. The characterisation project will provide details important for the stratification of catch monitoring, e.g., gear types, regions, and seasons. Areas of application (e.g. 1, 2, 3) will be determined by PELWG subject to review of characterisation study.

The results and conclusions of the stock assessment modelling (KAH2005/01) will determine the future requirements for catch monitoring of commercial catches, in particular the periodicity of sampling and any future stratification.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- KAH 1, KAH 2, KAH 3 and KAH 8.

The project is estimated to cost between \$100,000 - \$150,000.

Project: Characterisation of pelagic fisheries using observer data

Project Code: PEL2005/01

Start Date: 1 July 2005

End Date: 30 October 2006

Vessel Use: None

Overall Objectives:

1. To describe pelagic fisheries and significant changes in pelagic fisheries through time utilising observer data.
2. To inform future observer data collection needs and utility of observer data in stock assessment.

Specific Objectives:

1. To describe the blue mackerel purse seine fishery based on observer data collected during 2004/05.
2. To describe the kingfish trawl bycatch fishery based on observer data collected during 2004/05.
3. To describe the pilchard purse seine fishery based on observer data collected during 2004/05.
4. To describe the kahawai purse seine fishery based on observer data collected during 2005/06.
5. To describe the trevally trawl fishery based on observer data collected during 2005/06.
6. To describe the tuna purse seine fishery based on observer data collected during 2004/05 and 2005/06.
7. To review shark conversion factor data collected by observers and the shark finning practices as observed in the tuna longline fishery.

Note:

This project should also provide feedback on improvements to future data collection by observers in these fisheries. Although some 2005/06 data may not be available until late in the timeframe of the project, given the importance of this project to future research planning, the project completion date must be met.

Rationale:

General

In New Zealand, observers have traditionally been deployed in large vessel deepwater fisheries. In those fisheries observer data have provided valuable descriptions of the fishing methods, the complete catch taken and biological data. For many of coastal small vessel fisheries, descriptions of the fishery do not exist, the non-target catch is unknown and especially where the catch is processed at sea biological data are sparse.

As a result observers have been deployed in various pelagic fisheries in recent years to allow detailed descriptions of fishery operations and detailed quantification of the catch, especially non-target species, to occur. Biological data have also been collected. This research programme will collate the observer data into a report that describes the fisheries observed and allows changes in the prosecution of the fisheries to be monitored over time.

This research is necessary because:

- Descriptions of non-target catch and fishery operations are not available for the many of the specified fisheries;
- A review of available observer data is important for determining future research programmes to underpin stock assessments and assessment of stock status in pelagic fisheries;
- The project has been identified as integral in the New Zealand Pelagic Fisheries Medium Term Research Plan; and
- If this project does not go ahead, our understanding of pelagic fisheries will not be furthered.

Within this context, this research project is considered a high priority.

Objectives 1 – 6

Observers are deployed to estimate catch size, obtain biological samples, collect catch and effort data, measure the size composition of the catch, collect biological samples, measure product conversion factors, report status of released fish and collect information on school behaviour/dynamics.

In recent years observers have been deployed in some pelagic fisheries for the first time. This exploratory observer coverage has occurred in different fisheries in different years.

These data should be used to describe each of the observed fisheries to allow significant changes in the fishery through time to be monitored. The observed non-target catch should be detailed along with preliminary estimates of fleet wide catch based on observer data. Any information on handling mortality should be carefully assessed and converted to estimates of incidental mortality. Any biological data including individual length, weight, sex and maturity information collected should be briefly summarised. This project will also inform future observer data collection needs.

Additional information on observer data collection plans can be obtained from OBS2004/05 and OBS2005/05 and the Observer Biological Manual.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- EMA 1, EMA 2, EMA 7, KIN 1, KIN 8, PIL 1, KAH 1, KAH 2, TRE 1, TRE 7, POS, BWS, MAK and SKJ.

The project is estimated to cost between \$50,000 - \$100,000.

Project: Stock monitoring of striped marlin

Project Code: STM2005/01

Start Date: 1 July 2005

Completion Date: 30 September 2006

Vessel Use: None

Overall Objectives:

1. To monitor striped marlin (*Tetrapturus audax*) within New Zealand fisheries waters.

Specific Objectives:

1. To update time series of catches, landings, and size composition data collected from a variety of sources up to the 2004/05 fishing year.
2. To estimate CPUE of striped marlin for the recreational fishery.

Note:

This project represents a continuation and expansion of the work undertaken under STM2003/01 'Characterisation of the striped marlin fishery'.

The outputs of this project will possibly include reports for various international fisheries organisations; however, these will be contracted separately as required.

Rationale:

General

Striped marlin forms the basis of a significant recreational gamefish fishery in New Zealand. Striped marlin are targeted and caught in moderate numbers each year although annual variations in summer oceanographic conditions cause wide fluctuations in catch levels. Up to 50% of the striped marlin that are caught in the recreational fishery are tagged and released. There is also an incidental catch in the pelagic longline fishery of uncertain size; however, commercial fishers are not allowed to retain striped marlin at this time.

While the Oceanic Fisheries Programme of the Secretariat of the Pacific Community recently compiled catch estimates for the western and central Pacific Ocean, there is no stock assessment for this region and it is not known if current levels of removals are sustainable.

The stock structure of striped marlin in the Pacific Ocean is not well known, but the focus of current research activities. The two most frequently considered hypotheses are: (1) a single-unit stock in the Pacific, which is supported by the continuous "horseshoe-shaped" distribution of striped marlin; and (2) a two-stock structure, with the stocks separated roughly at the Equator, albeit with some intermixing in the eastern Pacific. Currently the only stock assessment for of striped marlin in the Pacific Ocean is for the eastern Pacific Ocean, i.e., east of 150°W.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Striped marlin are outside the QMS and commercial fishers are not allowed to retain striped marlin at this time. In the absence of a Fisheries Plan for striped marlin, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of the striped marlin stock in relation to the B_{MSY} in a regional context.

A stock assessment of striped marlin specifically for New Zealand fisheries waters is not currently possible as the proportion of the South Pacific stock that migrates through and/or resides in New Zealand fisheries waters is unknown. In the absence of formal stock assessment, monitoring of striped marlin in New Zealand fisheries waters is based on monitoring the catches of striped marlin in the recreational fishery and the levels of bycatch in the commercial longline fisheries targeting tuna. The Gamefish Tag Recapture Programme also provides important information of the size and distribution of striped marlin released by recreational fishers. Recaptures provide information on movement, stock structure, handling mortality, time at liberty, and displacement rates that could potentially reduce uncertainty in the stock structure of striped marlin.

As New Zealand fishers encounter some of the largest and likely oldest striped marlin in the Pacific, the abundance of fish found within New Zealand fisheries waters will be sensitive to the status of the stock in addition to environmental factors that may also influence availability. For these reasons monitoring of the components of the stock that migrate through, or reside within, New Zealand fisheries waters will be important input for any future regional stock assessment.

This research is necessary because:

- Striped marlin supports a valuable recreational fishery;
- Stock status and stock structure of striped marlin is largely unknown, no stock assessment is available for this region;
- As the striped marlin found in New Zealand waters are among the largest encountered in the Pacific, trends in the abundance of this component of the stock could provide important indicators of the status of the stock and provide important information for future regional stock assessments;
- The project has been identified as integral to the billfish component of the New Zealand Pelagic Fisheries Medium Term Research Plan; and
- If this project does not go ahead, future regional stock assessments for striped marlin will be less reliable due to the lack of information on the largest individuals.

Within this context, this research project is considered a high priority.

Objective 1

Future stock assessments for striped marlin will rely heavily on accurate catch statistics. It is important that the various data series are clearly defined. For example, estimates of the numbers and sizes of fish landed may be collected from the various sport-fishing clubs, but these data will be collected separately from estimates of the numbers and estimated sizes of fish released. Size composition information could include both lengths and weights. Commercial estimates of catches will also be compiled from the appropriate sources (e.g., ENV projects).

The output of this objective will be time series of catches, landings, and size composition for the different sectors.

This objective will require significant interaction with sport fishing clubs and other sport fishing bodies.

Objective 2

Given that New Zealand fishers encounter some of the largest and likely oldest striped marlin in the Pacific, the abundance of fish found within New Zealand fisheries waters will be very sensitive to the status of the stock in addition to environmental factors that may also influence availability. For these reasons if a relative abundance index could be obtained for some part of the fishery, this might provide a useful monitoring tool in the short term and important input for any future stock assessment.

One or several CPUE indices will be constructed for striped marlin within New Zealand fisheries waters. Careful consideration will be required of both the spatial distribution of effort and consistency of the fleet. The length of the CPUE time series and spatial coverage will depend on available data. Changes in fishing practices and environmental influences should also be considered.

The output of this objective will be a relative abundance index for striped marlin caught in the recreational fishery.

Cost Recovery Information:

This project is 100% Crown funded.

The project is estimated to cost between \$50,000 - \$100,000.

Project: Stock monitoring of trevally

Project Code: TRE2005/01

Start Date: 1 September 2005

Completion Date: 31 March 2007

Vessel Use: None

Overall Objectives:

1. To monitor the length and age structure of commercial landings of trevally (*Pseudocaranx dentex*) in TRE 1 and TRE 7.

Specific Objectives:

1. To conduct the sampling and determine the length and age composition of commercial catches in TRE 1 during the 2005/2006 fishing year. The target coefficient of variation (c.v.) for the catch at age will be 20 % (mean weighted c.v. across all age classes).
2. To conduct the sampling and determine the length and age composition of commercial catches in TRE 7 during the 2005/2006 fishing year. The target coefficient of variation (c.v.) for the catch at age will be 20 % (mean weighted c.v. across all age classes).

Note:

The duration of this project will allow the successful tenderer time to analyse the results from sampling over the entire 2005/2006 fishing year and report their findings to the Pelagic Fishery Assessment Working Group during February-March 2007.

Where possible synergies with other shed sampling programmes in the areas of interest will be created.

Rationale:

General

Trevally is caught around the North Island and the north of the South Island, with the main catches from the northern coasts of the North Island. Trevally is taken in the northern coastal mixed trawl fishery, mostly in conjunction with snapper. In the western coastal mixed trawl fishery, trevally is taken mostly in conjunction with snapper although it is also targeted for part of the year. Since the mid 1970s trevally has been taken by purse seine, mainly in the Bay of Plenty, in variable but often substantial quantities. Set net fishermen take modest quantities. Combined commercial landings totalled 3313 t in 1999/2000, with a landed value around \$ 3 million. The largest fisheries in 2002/2003 were in TRE 1 (1014 t) and TRE 7 (2029 t).

Trevally is popular with recreational fishers, especially in the northern regions where annual recreational catches are estimated to be about 200 t in TRE 1.

For TRE 1 and 2 recent catch levels are considered sustainable and are probably at levels that will allow the stocks to move towards a size that will support the MSY.

For these two Fishstocks, catches at the levels of the TACCs are probably sustainable. For the TRE 7 base case assessment, and the more plausible sensitivity analyses, current biomass is estimated to be at the B_{MSY} level and current total catches are near the estimate of MSY. Recent catch levels appear sustainable but it is not known if the current TAC is sustainable. The stock status of TRE 3 is unknown, although catches are very small.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Trevally are within the QMS. In the absence of a Fisheries Plan for any of the trevally Fishstocks, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of the trevally stocks in relation to the B_{MSY} .

A recent assessment for TRE 7 is uncertain and requires additional CPUE data, as recent catches appear to be at about the MSY level. For TRE 1 and TRE 2 no formal recent assessment is available, but a catch sampling programme is in place for TRE 1 to monitor the status of that stock. A TRE 1 assessment is currently underway. The TRE 2 stock is not currently monitored, but catches are modest. Some catch sampling of that fishery may be timely. As for many other inshore pelagic species, the development of a robust index of abundance is a priority. An updated TRE 7 assessment is also underway 2004/05 with new CPUE data and additional catch sampling data. However, indications from recent work on the assessment are that several years of additional catch sampling data are required. On that basis this work is proposed for TRE 7 in 2005/06. The need for future years of catch sampling in TRE 7 will be assessed on the basis of the 2005/06 stock assessment outputs.

This research is necessary because:

- Trevally support valuable inshore commercial fisheries and are also a popular species for recreational fishers;
- While it is thought that recent TRE 1 and catches are considered sustainable, the first formal stock assessment is only currently underway and a time series of catch-at-age data from the commercial fisheries are important inputs to this stock assessment;
- While recent catches in TRE 7 appear to be at about the MSY level, the stock assessment is uncertain and requires additional CPUE and catch-at-age data. A time series of catch-at-age data from the commercial fisheries are important inputs to this stock assessment; and
- If this project does not go ahead, the lack of catch-at-age data for these fisheries would introduce considerable uncertainty to the stock assessments.

Within this context, this research project is considered a high priority.

Objective 1

In TRE 1, age structure was historically used to monitor stock status because a quantitative assessment of the fishery was deemed problematic. Recent developments in aerial sightings data mean a stock assessment is underway.

This programme will continue the time series of catch-at-age data available for future stock assessments in TRE 1. Changes to the age structure of landed trevally, such as a pronounced reduction in catches of large or old fish, is the type of signal that might indicate that the Fishstock is under pressure.

In 2004, the Pelagic Fishery Assessment Working Group reviewed the results of previous trevally fish shed sampling, and recommend that the catch sampling programme should be informative using a five year cycle including three years catch sampling followed by a two year break. After a break from sampling in 2003/04 and 2004/05, sampling is due to resume in 2005/06. The future frequency of catch sampling programmes will be reviewed during the current stock assessment project.

This catch sampling programme should replicate the programme undertaken in 2002-03. Additional information on the catch sampling programme for TRE 1 can be obtained from NZFAR2003/48.

Objective 2

In TRE 7, age structure was historically used to monitor stock status because a quantitative assessment (in particular an index of abundance) of the fishery was deemed problematic. Recent developments in CPUE standardisation mean a revised stock assessment is underway. This programme will continue the time series of catch-at-age data available for future stock assessments in TRE 7. Changes to the age structure of landed trevally, such as a pronounced reduction in catches of large or old fish, is the type of signal that might indicate that the Fishstock is under pressure.

In 2004, the Pelagic Fishery Assessment Working Group reviewed the results of the CPUE standardisation and revised assessment, and recommended that catch sampling should recommence in 2005/06. The future frequency of catch sampling programmes will be reviewed after the current stock assessment project is complete.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- TRE 1 and TRE 7.

The project is estimated to cost between \$100,000 - \$150,000.

Project: Characterisation of the New Zealand tuna fisheries

Project Code: TUN2005/01

Start Date: 1 October 2005

Completion Date: 30 September 2007

Vessel Use: None

Overall Objectives:

1. To characterise the New Zealand tuna fisheries, including catches of important associated tuna like species.

Specific Objectives:

1. To characterise the New Zealand tuna fisheries for albacore (*Thunnus alalunga*), bigeye tuna (*Thunnus obesus*), Pacific bluefin tuna (*Thunnus orientalis*), skipjack tuna (*Katsuwonus pelamis*), southern bluefin tuna (*Thunnus maccoyii*), yellowfin tuna (*Thunnus albacares*), and swordfish (*Xiphias gladius*) in the New Zealand fisheries waters and adjacent areas for the 2004/05 fishing year.
2. To characterise the New Zealand tuna fisheries for albacore (*T. alalunga*), bigeye tuna (*T. obesus*), Pacific bluefin tuna (*T. orientalis*), skipjack tuna (*K. pelamis*), southern bluefin tuna (*T. maccoyii*), yellowfin tuna (*T. albacares*), and swordfish (*X. gladius*) in the New Zealand fisheries waters and adjacent areas for the 2005/06 fishing year.

Note:

The current project TUN2003/02 'Characterisation of the New Zealand tuna fisheries' finishes in September 2005 and will include analyses of data for the 2002/02 and 2003/04 fishing years.

The outputs of this project will likely include reports for various international fisheries organisations; however, these will be contracted separately as required.

Rationale:

General

New Zealand tuna fisheries catch a range of species: albacore (*T. alalunga*), bigeye (*T. obesus*), pacific bluefin (*T. orientalis*), skipjack (*K. pelamis*), southern bluefin (*T. maccoyii*) and yellowfin (*T. albacares*) tunas. Swordfish (*X. gladius*) are taken as bycatch in the tuna longline fisheries.

Recent catches for albacore and skipjack range 3 000 to 9 700 t per year over the past four years, swordfish catches were about 1 000 t, and catches for the other four tuna species combined are a further 1 000 t per year. Estimates of the landed value of tuna fisheries indicate an aggregate annual value exceeding \$NZ 45 million.

The status of these stocks are determined in a regional context. Based on assessments for the western and central Pacific Ocean, exploitation rates for albacore and skipjack are considered low with current catches likely to be sustainable in the medium term. Bigeye and yellowfin tuna are either fully exploited, or nearing full exploitation, and for bigeye it is not known if current catches are sustainable.

The Interim Scientific Committee (ISC) is currently developing a detailed stock assessment for Pacific bluefin. At this stage the assessment is preliminary and thus uncertain. It is not known if current catches are sustainable or will help the stock move toward the level that will support the MSY. There is concern about the high fishing mortality on juvenile fish.

Southern bluefin tuna are assessed as a single Pacific Ocean/Indian Ocean/Tasman Sea stock, with the New Zealand catch accounting for approximately 2.5% of the global total. Although the results of recent stock assessments are uncertain, exploitation rates are considered high. Stock biomass, although at low levels, is thought to be stable with recent removals close to recent surplus production. It is thought that recent catch levels are unlikely to allow the stock to move towards a size that equates to the 1980 parental biomass by 2020.

Presently, there is no regional stock assessment for swordfish and so the status of the stock is unknown and it is not known if current catches are sustainable. A stock assessment for swordfish is currently being developed (SWO2003/01 and SWO2004/01).

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

Bigeye (*T. obesus*), Pacific bluefin (*T. orientalis*), southern bluefin (*T. maccoyii*), yellowfin tuna (*T. albacares*), and swordfish (*X. gladius*) are scheduled for introduction into the QMS on 1 October 2004. Albacore (*T. alalunga*) and skipjack tuna (*K. pelamis*) are proposed for introduction into the QMS on 1 October 2005. In the absence of a Fisheries Plan for any of these Fishstocks, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of these stocks in relation to the B_{MSY} in a regional context.

Tuna comprise a significant fishery for highly migratory species in New Zealand fisheries waters, and by New Zealand fishers on the high seas. Understanding these fisheries is important for both domestic management and the development of New Zealand's position in regional fisheries management organisations.

From late 2004, the newly established Western and Central Pacific Fisheries Commission (WCPFC) will review assessments of these species (except southern bluefin). Southern bluefin tuna is assessed by Commission for the Conservation of Southern Bluefin Tuna (CCSBT). A stock assessment for swordfish is currently being developed (SWO2003/01 and SWO2004/01). New Zealand participates in both the WCPFC and CCSBT.

Estimates of our catches and catch rates of these species are important for monitoring the component of these stocks that are found within New Zealand fisheries waters and also as an input for the regional stock assessments. The information and analyses that occur in this project are also key technical inputs to reports prepared separately to meet New Zealand's international obligations.

This research is necessary because:

- These species support valuable commercial fisheries;
- The characterisation of these fisheries is our only tool for monitoring the status of the components of these stocks encountered in New Zealand fisheries and form important input for the assessment and monitoring of these species in a regional context;
- The project has been identified as integral to the tuna and billfish components of the New Zealand Pelagic Fisheries Medium Term Research Plan; and
- If this project does not go ahead, we will have no means for monitoring the components of the greater tuna and swordfish stocks that are encountered in New Zealand tuna fisheries and we will be in breach of our international obligations.

Within this context, this research project is considered a high priority.

Objective 1 and 2

For the reasons described above, understanding the status of tuna and swordfish stocks requires both the analysis of catch, effort and observer data from within New Zealand fisheries waters and knowledge of the wider stock and fishery dynamics.

A variety of information sources exist that describes elements of these fisheries, and these should be clearly collated into a single source document (see TUN2003/02 outputs for an example of the expected detail). Fishers and fisheries stakeholder organisations (e.g. SeaFIC) should be utilised as a reference source for economic information.

Where available information on the economics of the fishery and information describing recreational tuna fisheries should also be incorporated.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- SWO 1, TOR 1, STN 1, YFN 1, BIG 1, SKJ and ALB.

The project is estimated to cost between \$150,000 - \$200,000.

Project: Development of a commercial catch sampling programme for highly migratory fish species

Project Code: TUN2005/02

Start Date: 1 July 2005

Completion Date: 30 September 2006

Vessel Use: None

Overall Objectives:

1. To develop methods with which to collect biological information describing highly migratory fish species from shore-based fish processing and handling facilities.

Specific Objectives:

1. To develop and implement a shore-based biological catch sampling programme for swordfish.
2. To describe methods for application of a broad scale shore-based catch sampling programme for all highly migratory fish species.

Rationale:

General

Highly migratory species represent an important component of New Zealand fisheries. For one component, the tuna fisheries, the landed value of the fisheries exceeds \$NZ 45 million. Understanding these fisheries is important for both domestic management and the development of New Zealand's position in regional fisheries management organisations.

The status of many of these species, e.g. the main tuna species, is determined from stock assessments undertaken in a regional context, but for many species, e.g. pelagic sharks, there is very little information available on the status of the stocks and sustainability of current removals.

The Ministry of Fisheries *Strategic Plan 2003/08* identifies a single goal "Maximise the value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment".

On 1 October 2004, four species of tuna, three species of pelagic sharks, two bycatch species, and swordfish are scheduled for introduction into the QMS. In the absence of a Fisheries Plan for any of these Fishstocks, and while Stock Strategies are being developed, the Ministry of Fisheries' is attempting to monitor the status of these stocks in relation to the B_{MSY} in a regional context.

From late 2004, the newly established Western and Central Pacific Fisheries Commission (WCPFC) will review assessments of many of these species. Southern bluefin tuna is assessed by Commission for the Conservation of Southern Bluefin Tuna (CCSBT).

A stock assessment for swordfish is currently being developed (SWO2003/01 and SWO2004/01). As noted above, stock assessments are not available for pelagic sharks, although biological information indicates that these species may be vulnerable to overfishing.

Currently we collect biological information about highly migratory species (e.g. tunas, billfish and pelagic sharks) from observers at sea in the tuna longline fishery. These data are summarised in the ongoing fishery characterisation projects (TUN2005/01). One exception is the albacore catch sampling programme. The low quantity of data collected annually due to low levels of observer coverage often means waiting several years to answer key questions and greatly reduces our ability to monitor the components of the stock that migrate through or reside in New Zealand fisheries waters.

To increase the quantity of biological data about highly migratory species collected we have two main options. One is to increase observer data collection and the other is to sample fish ashore. To increase observer data collection requires either a refocus in observer duties at sea and a subsequent loss of other data that would have been collected during the reprioritised time or, increase the number of observer days in the fishery. From time to time observer duties are reprioritised to answer specific biological questions. An increase in observer days is currently occurring in the tuna longline fishery. However, the quantum of biological data collected is still not adequate for many species and options to further increase the amount of biological data collected need to be developed.

This research is necessary because:

- These species support valuable commercial fisheries;
- Many of these species have recently been introduced into the QMS and current levels of observer coverage do not provide sufficient information for the monitoring of these stocks;
- Catch sampling for these species will provide critical data for future stock assessments and a possible means for monitoring the stocks in the absence of a stock assessment;
- The project has been identified as integral to the tuna, billfish, and pelagic shark components of the New Zealand Pelagic Fisheries Medium Term Research Plan; and
- If this project does not go ahead, our ability to monitor the landings of highly migratory species will be greatly reduced, future stock assessments will be less reliable, and it will not be possible to determine if landings are sustainable.

Within this context, this research project is considered a high priority.

Objective 1

Sexed length frequency data from swordfish can be an important stock monitoring tool for this species. Internationally, changes in the length frequency of the catch have been an important forewarning of overexploitation.

Swordfish in New Zealand waters cover a broad range of sizes currently, although in recent years the number of smaller swordfish landed may have increased as a proportion of the total landings.

Swordfish are generally landed at least part processed and accordingly shore-based data collection may be limited to less than full body measures (e.g. dressed weight versus greenweight). Data collected from whole swordfish at sea can be used to correlate shore-based measures of part fish.

Under this objective the successful tenderer will develop and implement a shore-based biological catch sampling programme for swordfish. To develop a shore-based programme the tenderer will require details of where swordfish landings occur, the frequency and quantity of landings, landed states and the types of biological data that can be collected. Details of sampling programmes implemented in other regions (either by individual countries or Regional Fisheries Management Organisations) should be investigated in determining the necessary intensity of sampling effort.

Objective 2

On the basis of experience gained in undertaking Specific Objective 1 and utilising information collected specifically about the other highly migratory species describing how, when and where they are landed, processed and transported, this research should describe methods for application of a broad scale shore-based catch sampling programme for all highly migratory fish species. Species to be considered include: yellowfin, bigeye, pacific bluefin, and southern bluefin tuna; mako, blue and porbeagle sharks; and moonfish.

Any data collection recommended should be considered in the context of needing to contribute to regional stock assessments for these stocks in the medium term. Details of sampling programmes implemented in other regions (either by individual countries or Regional Fisheries Management Organisations) should be investigated in determining the necessary intensity of sampling effort.

The output from this objective will be resources that will help fishery managers determine future approaches to the monitoring of these stocks.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- SWO 1, TOR 1, STN 1, YFN 1, BIG 1, MAK 1, MOO 1, BWS 1 and POS 1.

The project is estimated to cost between \$100,000 - \$150,000.

Project: Research Observer Services – Pelagic Fisheries

Project Code: OBS2005/05

Start Date: 1 July 2005

Completion Date: 30 September 2006

Vessel Use: Deployments on commercial fishing vessels

Overall Objectives:

1. To collect specified data describing pelagic fisheries and the effects of fishing in pelagic fisheries for pelagic fisheries research.

Specific Objectives:

1. To describe the catch including discards in the EMA fisheries, to collect biological data about EMA and other species as directed in the EMA fisheries, and to collect data to characterise the EMA purse seine fishery.
2. To describe the catch including discards in the JMA fisheries, to collect biological data about EMA and other species as directed in the JMA fisheries, and to collect data to characterise the JMA trawl and purse seine fisheries.
3. To describe the catch including discards in the KAH fisheries, to collect biological data about KAH and other species as directed in the KAH fisheries, and to collect data to characterise the KAH purse seine fishery.
4. To describe the catch including discards in the KIN fisheries, to collect biological data about KIN and other species as directed in the KIN fisheries, and to collect data to characterise the KIN trawl bycatch fishery.
5. To describe the catch including discards in the TRE fisheries, to collect biological data about TRE and other species as directed in the TRE fisheries, and to collect data to characterise the TRE trawl and purse seine fisheries.
6. To describe the catch including discards in the PIL fisheries, to collect biological data about PIL and other species as directed in the PIL fisheries, and to collect data to characterise the PIL purse seine and trawl bycatch fisheries.
7. To describe the catch including discards in the tuna, pelagic shark and billfish fisheries, to collect biological data about tuna, pelagic sharks and billfish and other species as directed in the tuna, pelagic shark and billfish fisheries, and to collect data to characterise the tuna, pelagic shark and billfish longline and purse seine fisheries.

Observer Services Required:

1350 days required for pelagic fisheries, 1000 for tuna longline, 60 for SKJ purse seine, 250 for JMA, 20 for KAH, and 20 for TRE in 2005/06. See the rationale section below for further details of the sampling plans.

Note:

The services specified in the sampling plan are subject to ongoing review and revision by the Ministry and the Pelagic Fisheries Stock Assessment Working Group. Such review will also take account of obligations with respect to regional fisheries organisations relating to tuna. This project will also provide descriptive data for Aquatic Environment research.

Rationale:

General

In pelagic fisheries observer data represent the only detailed quantification of catch on a set-by-set basis available to scientists. Observer data are independent of the fishery and accordingly provide valuable insight into fishery dynamics through time. Observers collect catch effort data, biological data and biological specimens for a variety of science purposes. In particular, observers are able to provide data describing biological parameters that cannot be captured from other catch sampling techniques (e.g. shed sampling). Observer data often provide the only source of detailed biological information about fish in pelagic fisheries, especially in those fisheries where a considerable amount of processing occurs at sea.

History

The pelagic fisheries observer programme since 2001/02 is detailed in Table 1 below.

	2001/02		2002/03		2003/04		2004/05	2005/06
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Proposed
JMA	95	89	95	96	95	72	150#	250#
Tuna Domestic	150	104	200	127	200	122	450*	700*
Tuna Charter	200	177	200	194	200	258	300	300*
EMA	-	-	-	-	-	-	20@	-
SKJ	-	-	-	-	-	-	30@	60@
PIL	-	-	-	-	-	-	10@	-
KIN	-	-	-	-	-	-	20@	-
KAH	-	-	-	-	-	-	-	20@
TRE	-	-	-	-	-	-	-	20@
Total	445	370	495	417	495	452	1030	1350

Table 1: Observer sea days planned and sea days achieved from 2001/02 – 2004/05, and proposed sea days for 2005/06.

This increase is needed to allow statistically robust estimates of species composition in the catch to be determined in JMA 7 for stock assessment purposes.

* This increase is required to get closer to the desired 10% coverage in this fishery (required a variety of science purposes, including non-target catch estimation and determination of biological parameters for target and non-target species).

@ Exploratory coverage to provide fishery characterisation, not intended to provide a statistical sample.

Note that jack mackerel samples are to be collected from the squid and hoki fisheries, and blue mackerel samples are to be collected in the hoki fishery during 2004/05 and 2005/06.

Sampling Plan for 2005/06

For all pelagic fisheries: observers are requested to be aware of and report tagged fish, especially species tagged in the NZ gamefish tag programme (YFN, KIN, MAK & STM), the CCSBT STN programme and other regional programmes for SKJ, BIG, YFN and ALB.

For JMA: 250 days in the JMA 7 target trawl fishery- at least one sample per day, preferably one sample per tow of the target species; JMM otoliths where possible; dolphin/trawl interactions in the Taranaki Bight - direct observation of hauls for incidental mortality should be 100% where two observers are present opportunistic sampling in the SQU/HOK trawl fisheries.

For domestic tuna longline: 700 days in the target fishery – 55 days per month June-March, 75 days per month April & May; LF data on BIG, SBT, TOR, ALB, YFN, SWO; detailed data on non-target catch to allow estimation of total non-target catch; opportunistic tagging of fish; data on status of fish at capture; data on shark conversion factors; collection of striped marlin ageing structures; collection of BWS ageing structures; Pacific bluefin and southern bluefin tuna tissue samples; and, seabird/longline interactions.

For charter tuna longline: 300 days in the tuna target longline fishery – all vessels during autumn fishery; LF data on STN, TOR, ALB, SWO; detailed data on non-target catch to allow estimation of total non-target catch; data on status of fish at capture; opportunistic tagging of fish; data on shark conversion factors; and, seabird/longline interactions.

For purse seine tuna: SKJ – 60 days of summer target purse seine fishery; data describing the non-target fish catch; SKJ biological data.

For KAH: purse seine – 20 days of target fishery; non-target catch estimation; and, length frequency and otoliths. For TRE: trawl – 20 days of target trawl catch; non-target catch estimation; and, length frequency and otoliths.

The biological samples required in the target fisheries are detailed in the Observer Biological Manual. The other sampling priorities in these fisheries are the full and accurate quantification of the catch, the biological sampling of other target species e.g. MOO & RBM, the biological sampling of non-target pelagic species e.g. POS & MAK, any EMA/JMA biological samples in the HOK/SQU fishery, conversion factor data and other sampling as notified to the Observer Programme. Alterations to sampling plans and additional data requests will be by way of a *request for the collection of samples* or a *request for the collection of data*.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following fishstocks according to rule 8 of the Fisheries (Cost Recovery) Rules 2001:

- JMA 7 (250 days);
- BIG, STN, TOR, ALB, YFN and SWO (1000 days combined);
- SKJ (60 days);
- KAH 1, KAH 2 and KAH 8 (20 days combined); and
- TRE 1 and TRE 7 (20 days combined).