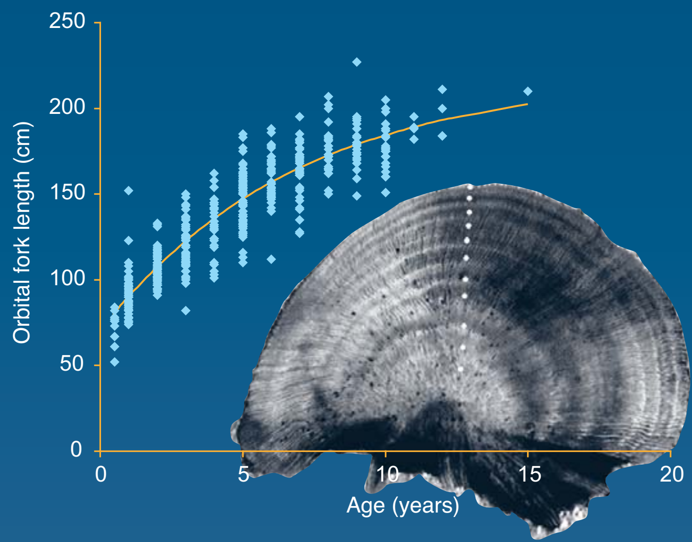
Age and growth of broadbill swordfish (*Xiphias gladius*) from Australian waters

Jock Young & Anita Drake



CSIRO MARINE RESEARCH
Australian Government Fisheries Research and Development Corporation
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Overall Objectives

1. Collect sufficient samples from at least five age classes of broadbill swordfish so that a validation study can be completed
2. Collect ray samples for known-sex fish from a representative sample of the size range of the fishery
3. Determine whether the cycle of increment deposition at the margin of the anal fin ray is annual thus providing a validation that bands are laid down annually
4. Dependant on successful validation, provide a sex-separated estimate of mean size-at-age for the east coast swordfish population.

Outcomes achieved:

This study provided the first description of age and growth of broadbill swordfish in the Australian region. We found that anal fin rays could be used to age swordfish in Australian waters. The age and growth parameters from this study have already been applied to an operational model used to assess variations in fishing pressure on the species in the Eastern Tuna and Billfish Fishery (Campbell and Dowling 2002). The resulting length at age curve was used to convert size at maturity to age at maturity. The finding that 50% of female swordfish reach sexual maturity at ~10 years is a major concern for the species, particularly when an earlier estimate for female swordfish caught in our region was 4-6 year, and 90% of the female swordfish caught by the fishery are less than ten years old.

We showed that the relationship between age and length for the eastern and western populations of swordfish overlapped supporting the notion that swordfish in the Australian region are linked. We developed an age at length key which we applied retrospectively to the catch by the fishery from 1997 to 2001 for the eastern swordfish fishery and from 1999 to 2002 for the western fishery. Over the study period there was an apparent shift from older to younger age swordfish in the catch by the fishery. Whether this reflected a recruitment pulse or to overfishing is yet to be determined, although the decline in the proportion of older age fish in the catch is similar to swordfish fisheries elsewhere where fishing impacts have been reported. Although our sample size was small for the western fishery we found no evidence of decline in the catch at age during the study period.

1. Non technical summary

The age and growth of broadbill swordfish (*Xiphias gladius*) was examined from fish caught by the domestic longline fishery [the eastern tuna and billfish fishery (ETBF)], off eastern Australia mainly between May 1999 and March 2003. A preliminary study was also completed on the age and growth of swordfish caught by the southern and western tuna and billfish fishery (SWTBF) off Western Australia during the same period. The project was largely funded by the FRDC although additional funding was obtained from AFMA. The project was actively supported by the east coast longline fishery, and also by the SWTBF through collection of samples.

A preliminary study by Clear et al (2000) confirmed earlier studies of swordfish age and growth that counting the annuli in transverse sections of the second anal fin ray was the most efficient and direct way to estimate the age of the fish. We followed this methodology although we also investigated the use of otoliths to determine the growth of fish up to 2 years old using presumed daily growth increments.

We examined the fin rays of 1589 swordfish, consisting of 1064 females and 447 males from eastern Australian waters. Of these, 1511 had annuli sufficiently clear for us to determine their age. Our first objective was to validate that the annuli observed in the rays were deposited annually. There is as yet no way to directly validate their formation as this requires an extensive mark and recapture program, preferably with chemical marking. As swordfish are relatively solitary animals and are difficult to capture and return safely to the wild, the techniques used to directly validate schooling species such as the tunas could not be applied in this study. We therefore used a variety of subjective and objective techniques to examine whether there was an annual cycle of increment formation in the outermost annulus of the fin ray. Using these techniques we observed that when all samples were combined there was a general pattern of increment formation from winter through to completion the following autumn. However, we were unable to verify this pattern, with the exception of female age class 4 and males age 3, for individual age classes, partly due to a lack of sampling over the winter months. Nevertheless, the combination of analyses we used, including a comparison of readings with other laboratories, indicated that the opaque bands we observed were formed annually.

The oldest female we examined was estimated to be 18 years old; the oldest male was 15 years old. Approximately 90% of the females sampled were less than 10 years old: 50% were ≤5 years old. Our previous study of swordfish reproductive biology determined that ~200 cm (OFL) was the size at which 50% of the population was reproductively active. This size equated to a 10 year old fish, which was significantly higher than the 4 to 6 years previously reported for swordfish in the Australian region. We determined growth parameters using the Von Bertalanffy relationship for eastern swordfish with parameters of $L\infty$, K and t_0 of 296.0, 0.08, and -3.7 respectively for females and 224.2, 0.13 and -3.0 for males. There was no significant difference in mean length at age between males and females up to age 9. After this time females grew significantly faster and lived longer than males. The resulting growth curves fell within a range of growth curves established for swordfish from fisheries elsewhere in the world except for that determined for swordfish from the Mediterranean Sea. Because of the rapid growth in the first year in which fish reach ~80 cm in (orbital fork) length, we examined assumed daily increments in 22 juvenile swordfish and were able to establish a growth relationship for the first year of life.

We developed age length keys and retrospectively estimated the age distribution of the swordfish catch by the eastern fishery between 1997 and 2001. The catch at age showed a decline in the age of the catch from predominantly 4 to 6 year old fish to 2 to 4 year olds over the study period. We also noted spatial differences in the age structure of the catch with significantly younger fish caught in inshore waters over the Australian winter.

We also examined a smaller set of rays collected from the SWTBF (n=188) with the support of a CSIRO summer studentship. The resulting growth curve gave parameters of $L_\infty = 296.51$, $k = 0.1096$, $t_0 = -3.0118$, for females and $L_\infty = 236.90$, $k = 0.0815$, $t_0 = -3.02$ for males. A comparison of growth curves between eastern (ETBF) and western (SWTBF) showed no significant difference in length at age between the two populations of swordfish. Fish aged between three and seven years generally dominated the SWTBF catch, with no trend evident in median age class caught over the study period.

Both studies demonstrated that the Australian swordfish catch was dominated by immature females. Off eastern Australia, the median age of fish caught had decreased. Whether this decrease was the result of increased recruitment or was the result of overfishing has yet to be determined. This pattern of declining age was not evident off Western Australia, possibly reflecting the relative lack of fishing pressure in the region. Recent legislation by the United States to limit entry by longline fishers to spawning grounds in the western Atlantic Ocean to limit the impact of fishing on small swordfish, has resulted in a dramatic rebuilding of swordfish stocks in the region. A similar approach may be necessary for the Australian region to ensure a sustainable future for the swordfish fishery.

Reference:

Clear, N., Davis, T. L. O. and Carter, T. (2000) Developing techniques to estimate the age of bigeye tuna and broadbill swordfish off eastern Australia: a pilot project. FRDC Grant 98/113

Key words: swordfish, age and growth, marginal increment analysis, fin rays, otoliths, growth curves, age length keys, east coast longline fishery, west coast longline fishery

2. ACKNOWLEDGEMENTS

This study would not have been possible without the support of the east coast longline fishery. In particular we would like to thank Tony Jerome, Mark Ebbels and Mark Fields and longline boat owners Brett Taylor and Grant Taylor for allowing us sea time on their vessels and for the collections they made on our behalf. Also, we would like to thank the Executive Director of the East Coast Tuna Boat Owners Association, Hans Jusseit, for ongoing support. We also thank the fishers and observers of the SWTBF for their contribution to this project. The project was funded by FRDC grant 2001/014. Additional funding was provided by AFMA. Technical assistance was provided by Thor Carter at sea and in the laboratory. We are grateful to Natalie Dowling, Rob Campbell and Jessica Farley for advice and support.

3. BACKGROUND

Broadbill swordfish, *Xiphias gladius*, is one of four pelagic species targeted by the growing Australian longline fishery. Although swordfish have been fished continuously by the Japanese longline fleet over the past twenty years in our region, the recent development of the eastern Australian longline fishery has seen catches increasing to their present annual catch of 2,400 tonnes, at least twice the amount caught by the Japanese. Annual catches in the western Australian fishery and off New Zealand for this species are greater than 1,000 tonnes each. However, it is as yet unclear whether this level of fishing is sustainable. Recent studies of the genetic makeup of Pacific Ocean swordfish indicate a separate southern hemisphere population extending to Western Australia highlighting the finite nature of this resource (Reeb et al 2000).

To determine whether this level of fishing is sustainable, management requires an assessment of the stock. Such an assessment requires data on mortality both from natural causes and from fishing, and on longevity. Defining these parameters requires accurate age determination, which has not been estimated for broadbill swordfish in Australian waters. Studies in the northern hemisphere indicate that swordfish can reach a maximum age of 9 years for males and 15 years for females (Wilson and Dean 1983), but with significant variations reported from different regions. Similarly, the rate at which these fish grow is affected by seasonal and environmental factors. Further, females grow faster and reach greater sizes than male swordfish.

This variation in age and growth characteristics presents one of the greatest problems for the operational model presently being developed for swordfish in Australian waters by Punt et al (1999). Their model is based entirely on a length-age relationship rather than direct ageing. Thus the resulting conversions have the potential to introduce uncertainty into the catch at age distribution translating into uncertainty in the assessment results. The variation between different ageing studies of swordfish around the world is shown by Table 1 in Ward and Elscot (2000). For example, length at age 8 years for females can range from 181 to 254 cm depending on sampling location and the ageing technique used.

Unfortunately, direct validation techniques have not been developed to determine the annual age of swordfish. The absence of information on direct age estimation for both swordfish and tropical tuna has led the ETMAC and the SWTBF MAC to rate these basic biological parameters highly (Priority 3 and 1 respectively) in their list of research priorities. As such, a series of studies have begun to determine key population parameters needed for the assessment of these stocks in Australian waters (e.g. Clear et al 2000, Gunn and Williams 1999, Williams 1997, Farley et al 2003). One of these studies has been monitoring size frequencies of the east coast stock since 1998 (Williams 1997). However, without the information to convert the size frequencies to age frequencies, the data is of limited value in stock assessment.

A pilot study was initiated by CSIRO Marine Research to determine the feasibility of estimating the age of swordfish and to examine which techniques would be most suitable (Clear et al 2000). The study supported Berkley and Houde's (1983) finding that the bands found in cross sections of the second anal fin ray of Atlantic Ocean swordfish showed the greatest potential to accurately determine the age of the fish, and that a full project was logistically feasible. Clear et al (2000) found indications of a seasonal cycle in the widths of the marginal increment – a technique to determine whether bands are deposited annually - from the swordfish they examined. They cautioned, however, that many more fish needed to be examined before a seasonal cycle in annulus formation could be validated. This conclusion reiterated the earlier work of Berkley and Houde (1983) who noted that further validation was essential. Thus, before a thorough age and growth study can begin, an intensive validation study needs to be completed. Failure to do so could lead to inaccurate stock assessments, the consequences of which have been felt by a number of exploited fisheries in the past (Beamish and McFarlane 1983). The recent reinterpretation of the age and growth of juvenile southern bluefin tuna came directly from an age validation study of the species (Clear et al 1999).

This project aimed to determine in the first instance whether the bands seen in cross section of the second anal ray of broadbill swordfish are deposited on an annual basis. This is an essential prerequisite for establishing an age length key for the species in Australian waters.

If these bands can be validated as annual then the determination of an age length key for the species can proceed.

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4. NEED

The swordfish fishery has expanded rapidly in the past few years off eastern Australia with annual catches greater than 2000 tonnes since 1997 (Campbell 2002a). When the fishery first began AFMA set a ‘trigger’ point of 800 tonnes, after which they would review the amount of fish taken. This has led to the development of a Total Allowable Effort which is presently being debated (Campbell 2002b). Similar rapid growth has been reported for the fishery for swordfish off Western Australia. Added to this is the developing New Zealand fishery now also reaching 1000 tonnes. This last point is relevant in that recent genetic evidence indicates a single stock encompassing all three fisheries. There is an urgent need, therefore to determine whether these catches are sustainable. However, the population parameters from which accurate stock assessment can be made have not yet been determined for the Australian region. To this end Eastern Tuna MAC and SWTBF MAC listed age and growth determination as priorities three and one respectively in their list of ten priority research issues. Standing Committee on Tuna and Billfish (SCTB 13) held in Noumea also noted the increase in swordfish fishing in the Western Central Pacific Ocean. They listed age and growth as a priority research issue for this species.

Age-based stock assessments of swordfish require input data on mortality, longevity, age at maturity and age structure; estimates that can be obtained from age and growth studies. Therefore, there is a clear need for an age and growth study of swordfish. However, without validation over a number of age classes, incorrect interpretations have lead to the wrong decisions by management. Therefore, before such an ageing study is begun the first priority is validation of the annual cycle of growth. With appropriate validation a length at age key, which is presently lacking, could be provided.

References:

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5. OBJECTIVES

1. Collect sufficient samples from at least five age classes of broadbill swordfish so that a validation study can be completed
2. Collect ray samples for known-sex fish from a representative sample of the size range of the fishery
3. Determine whether the cycle of increment deposition at the margin of the anal fin ray is annual thus providing an indirect validation that bands are laid down annually
4. Dependent on successful validation, provide a sex-separated estimate of mean size-at-age for the east coast swordfish population.

6. PROJECT RESULTS

6.1 Age and growth of broadbill swordfish, *Xiphias gladius*, in the domestic longline fishery off eastern Australia

Jock Young, Anita Drake and Melissa Langridge

6.1.1 Abstract

We estimated the age and growth of broadbill swordfish, *Xiphias gladius*, from 1589 fish collected from the longline fishing grounds off eastern Australia between 1995 and 2003. Significant linear relationships were found for both sagittal otoliths and second anal fin ray size with fish length indicating that both hard parts could be used as a proxy for somatic growth. However, although otoliths were useful for determining the age (in days) of young fish the second anal fin ray was found to be the most convenient hard part for counting annual increments. Two measures of marginal increment formation provided indirect validation of an annual cycle of band deposition in the fin rays. This conclusion was supported by counts of presumed daily increments of sagittal otoliths which agreed with the length at age of one year old fish. Swordfish grow rapidly in the first year after which mean growth rate of females was 11.3 cm per year up to year 10; male growth rate was slightly less for the same period (10.2 cm per year). The oldest female we sampled was estimated at 18 years old; the oldest male was 15 years old. Von Bertalanffy curves fitted to age at (orbital fork) length by sex gave growth parameters of $L\infty$, K and t_0 of 296.0, 0.08, and -3.7 respectively for females and 224.2, 0.13 and -3.0 for males. The resulting growth curves were similar to growth curves generated for swordfish from the Atlantic, Pacific and Indian Oceans and were only noticeably different from those for Mediterranean Sea swordfish. However, further refinement of our understanding of swordfish age and growth will be limited until direct age validation through marked recaptures of swordfish is achieved.

6.1.2 Introduction

Broadbill swordfish (*Xiphias gladius*) is one of four species targeted by the Australian domestic longline fishery. Although swordfish have been fished continuously by the Japanese longline fleet over the past twenty years off eastern Australia, the recent development of the eastern Australian longline fishery has seen catches increasing to more than 2000 tonnes per year since 1997 (Campbell 2002), at least twice the amount caught by the Japanese. Annual catches in the western Australian fishery and off New Zealand for this species are now at ~1,000 tonnes each. However, it is as yet unclear whether this level of fishing is sustainable. Recent studies of the genetic makeup of Pacific Ocean swordfish indicate a separate southern hemisphere population extending to western Australian waters highlighting the finite nature of this resource (Reeb et al 2000).
To determine whether this level of fishing is sustainable, an assessment of the stock is required. Such an assessment requires a number of inputs, including data on longevity and growth rates. Defining these parameters requires accurate age determination, which has not been estimated for broadbill swordfish in Australian waters. Studies in the northern hemisphere indicate swordfish can reach a maximum size of 9 years for males and 15 years for females (Wilson and Dean 1983), but with significant variations reported from different regions. For example, depending on region, the length at age 8 years for females can range from 181 to 254 cm (orbital fork length) (Ward and Elscot 2000). Further, females grow faster and reach greater sizes than the male swordfish. These variations in age and growth characteristics are a significant obstacle for the operational model being developed for swordfish in Australian waters (Punt et al 1999, Campbell and Dowling 2003). The operational model is based entirely on a length-age relationship rather than direct ageing. Thus, the resulting conversions have the potential to introduce uncertainty into the catch at age distribution translating into uncertainty in the assessment results.

A pilot study was initiated by CSIRO Marine Research to determine the feasibility of estimating the age of swordfish (Clear et al 2000). This study supported previous work that found the second anal fin ray to be the most useful hard part for ageing swordfish (Berkley and Houde 1983, Castro-Longoria and Sosa-Nishizaki 1998). Clear et al (2000) found indications of a seasonal cycle in the widths of the marginal increment – a technique to determine whether bands are laid down annually - from the swordfish they examined. They cautioned, however, that many more fish needed to be examined before a seasonal cycle in annual ring formation could be validated. This conclusion reiterated the earlier work of Berkley and Houde (1983) who noted in their study of the age and growth of Atlantic swordfish that further validation was essential.

The main techniques available to determine the age of swordfish are modal length frequency analysis, mark/recapture studies and examination of hard parts (Porter and Smith 1991). Because of variations in length at age and overlapping of size classes in older fish, modal analysis does not have the precision required to determine accurately the age structure of swordfish populations. Studies involving mark/recapture have only been of limited value because swordfish are solitary creatures and difficult, therefore, to tag sufficient numbers from which enough recaptures can be made to validate individual age classes. For these reasons most contemporary swordfish studies have concentrated on hard parts, specifically otoliths and anal fin rays. Although improvements in otolith preparation and analysis techniques have made their use more feasible, the use of the relatively larger cross sections of anal fin rays has advantages in terms of collection, processing and analysis (Castro-Longoria and Sosa-Nishizaki 1998).

Our aim in this study was firstly to provide indirect evidence for annual deposition of opaque and hyaline bands in cross section of the second anal fin ray of broadbill swordfish. We then aimed to provide a Von Bertalanffy curve for male and female swordfish and an age length key for the species in eastern Australian waters. Using annual weight frequency data, our objective was to estimate the age structure of the catch.

6.1.3 Methods

Collection of samples

Anal fins (and otoliths see Chapter 6.3) were collected along with gonad tissue from freshly caught swordfish by CSIRO observers and fishers from Australian waters between 1995 and 2003 (Fig. 1). Sampling was carried out on domestic longliners operating in the eastern EEZ and further collections were made in the western EEZ (see Chapter 6.2). With each sample, OFL (orbital fork length, the distance from the posterior edge of the eye orbit to fork of tail), capture position and date of capture were recorded. Samples were frozen on board and returned to the laboratory for processing.

Laboratory processing

For each sample, sex was confirmed, particularly for juveniles, by examination of gonads under stereomicroscope and through histology (Young et al 2003). Anal fins were thawed and the second anal fin ray removed and cleaned of all skin and tissue (Fig. 2). The second fin ray was regarded as the best ray for age estimation due to its small inner matrix and having the widest diameter. The first fin ray was generally very short and stout and often missing altogether. The bilaterally paired ray was split in two and the distance (D) was measured across the widest section of the condyle and a minimum of four transverse sections ~1.0 mm in width were cut along the length of the ray at locations equivalent to distances D/4, D/2, ¾D and D. Cuts were made using a diamond saw at either a high or low-speed, depending on the size of the ray. Sections were placed in small plastic vials labeled with a unique identification (ID) number and the section type (i.e. D, ¾D, D/2,

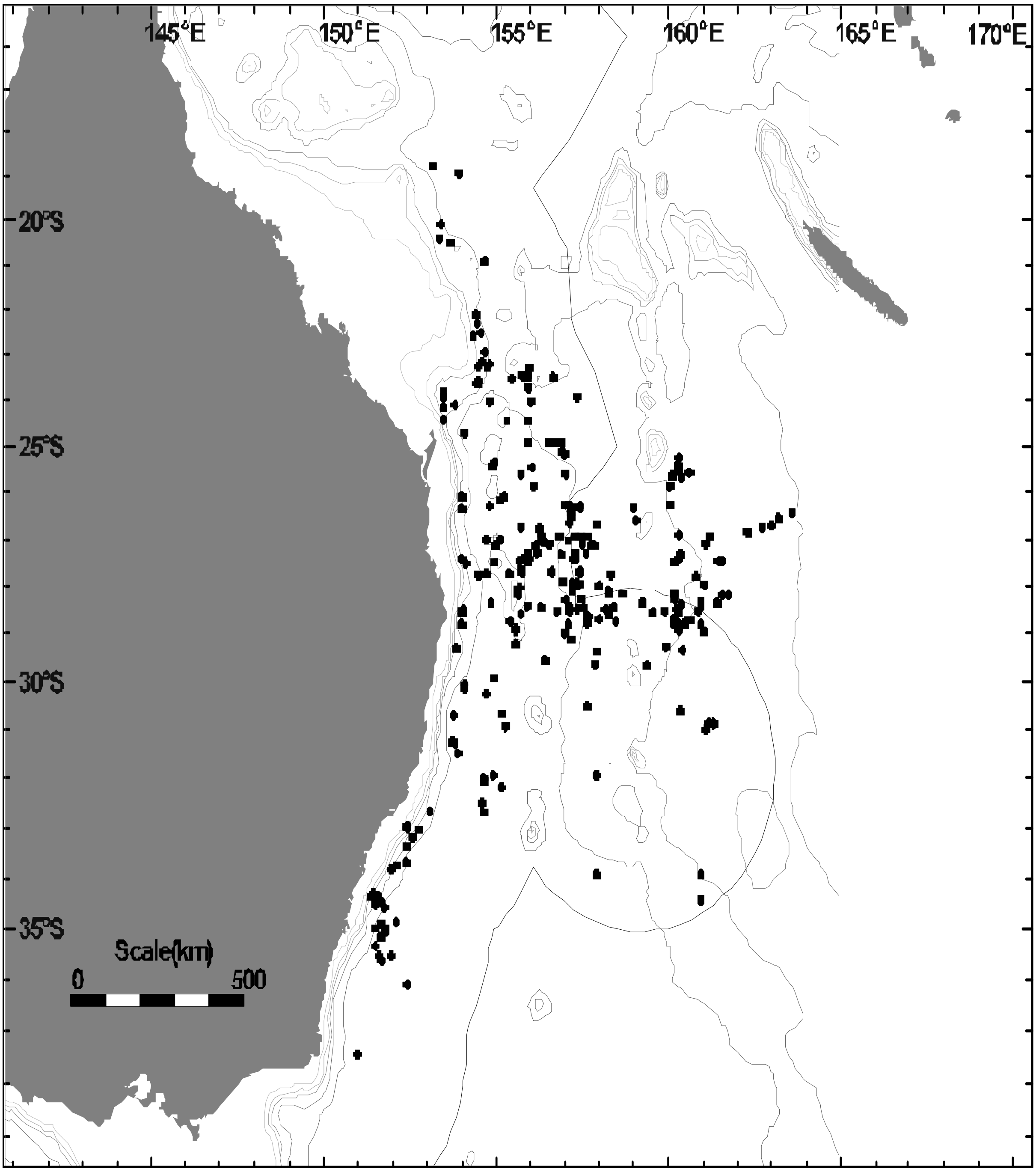


Figure 1: Position of capture of broadbill swordfish, *Xiphias gladius*, sampled for age and growth off eastern Australia

D/4), and immersed in 70% ethanol for one hour, before being rinsed with distilled water and placed in dichloromethane for an additional hour to improve band clarity (Berkeley and Houde 1983). Sections were air-dried, mounted with crystal bond on glass slides labeled with the ID number and section type, and stored for later reading.

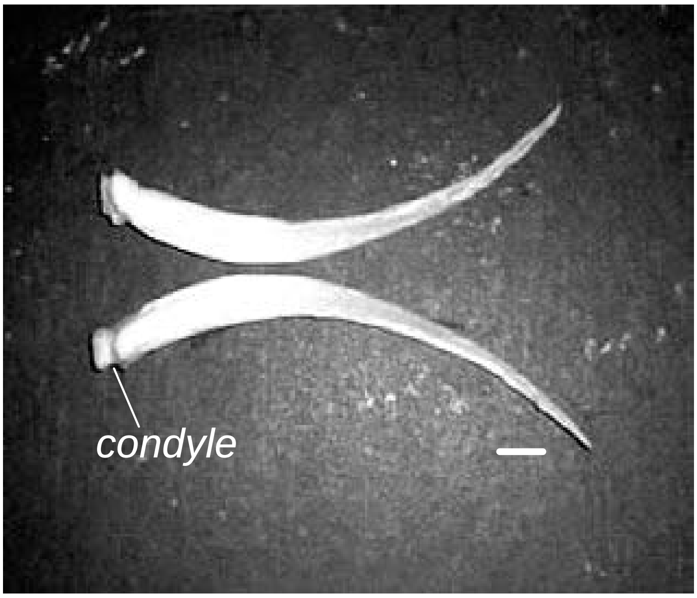


Figure 2: The second ray of the anal fin split in two. Transverse sections were taken from just above the condyle following the methodology outlined in the text (scale 1cm).

Sections were read using a Leitz stereomicroscope fitted with Phillips CCD camera in conjunction with NIH Image 1.5.4 computer software program. Sections were read at either 6X, 12X or 25X magnification, using transmitted light. The distance from the focus to the edge of the ray was measured along with the distance from the focus to the beginning of each dark growth band. Thick ray sections were sanded with wet and dry (used wet) sandpaper to improve readability. Each ray was given an age estimate by counting the number of paired hyaline and opaque bands (Fig. 3). Increment readings were taken from the start of each opaque band. Readability was scored from 1 – 5 (1 = highly confident, 2 = confident, 3 = reasonably confident, 4 = uncertain, 5 = unreadable). Each ray was read blind (i.e. no reference to length, date or position of capture) at least twice. A third reading was made on samples where the first two blind readings did not correspond. If a confident age estimate could still not be determined then the sample was removed from further analysis. All samples with a readability of 5 were deemed unreadable and not used in further analyses. Samples where the opaque and translucent areas were not clearly defined were considered unreadable as were some samples that contained multiple bands. Age estimates were given from the best section out of D/4, D/2, 3/4D and D.

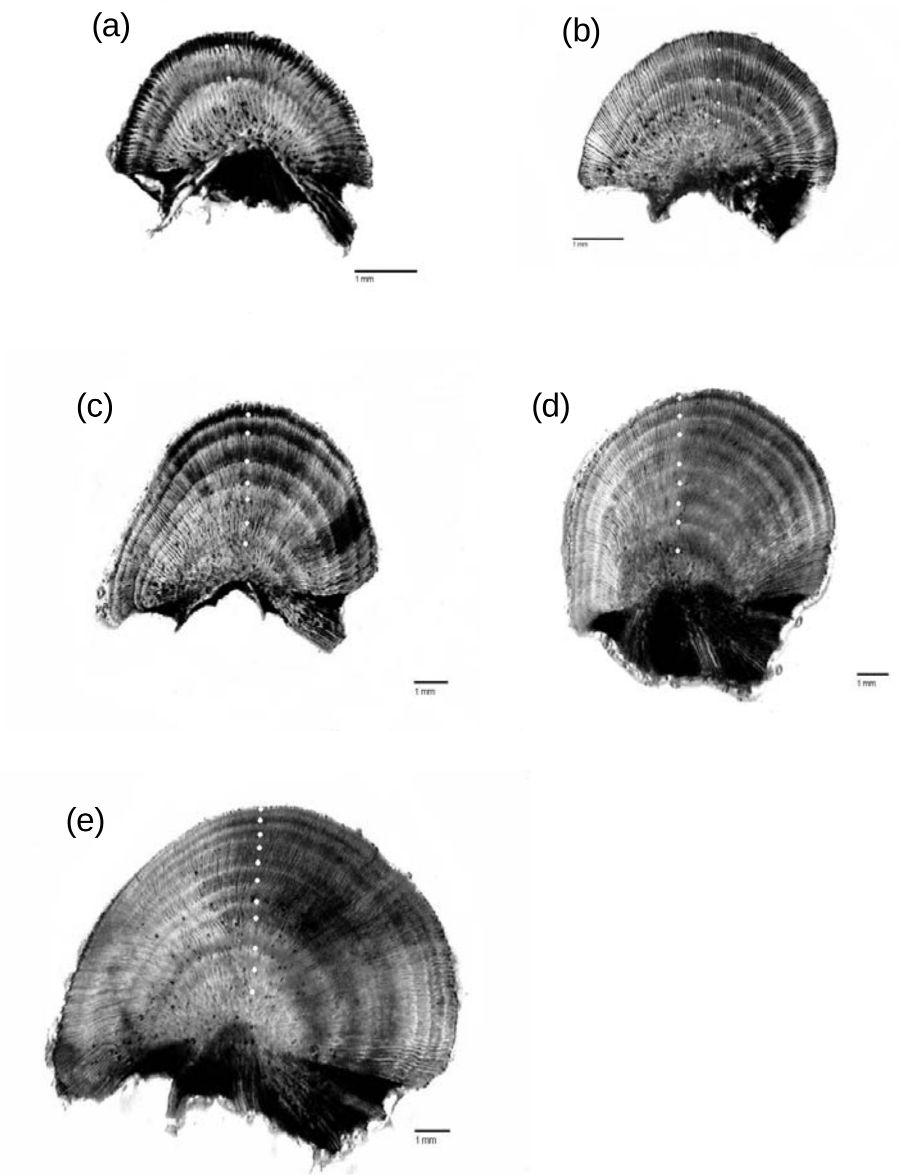


Figure 3: Transverse sections through the second anal fins of swordfish with (a) 2, (b) 4 , (c) 7, (d) 8 and (e) 11 annuli. An example of a clearly observed marginal increment can be seen in (b)

To determine whether the drying of whole rays before being sectioned altered readability a random selection of 10 rays was left to air dry while the corresponding pair was kept frozen until the time of sectioning. Once sectioned and the processing of the rays was complete there were found to be no significant differences between the readability of rays that were left to dry to those kept frozen (t test, $p<0.05$).

Indirect validation of annuli

The marginal increment -- the relative distance from the last complete increment to the edge of the ray-- was used to determine if individually observed bands composed of alternate hyaline and opaque bands are deposited annually (Berkley and Houde 1983, Campana 2001 and Sun et al 2002). The marginal increment was standardised against the width of the previous increment and plotted against the month of capture. Patterns were also interpreted subjectively using the edge type analysis outlined in Pearson (1996). The margin of each ray was given a score of 1-3. 1 = new dark band (thin opaque, the opaque zone is less than ¼ the width of the previous opaque zone), 2 = thick dark band (wide opaque, the opaque zone is more than ¼ the width of the previous opaque zone), and 3 = hyaline (white edge). Marginal increments were given a confidence reading of 1(highly confident) through to 5 (unreadable). We modeled the annual variation in increment widths following Peterson and Hall (2003). This method models the changes in the index of ring completion over time by fitting a logistic curve to the increments from swordfish collected throughout the year.

Growth

Growth functions were fitted to the swordfish length-at-age data by sex using the Von Bertalanffy equation:

Equation 1: $L_t = L_\infty(1-e^{-k(t-t_0)})$

where L_t is the orbital fork length (cm) at age t, L_∞ is the theoretical maximum orbital fork length, k is the growth parameter (per year), and t_o is the theoretical age (year) at zero length. A separate growth function substituting t_o with l_o (Equation2) was also fitted as length at t_o using Equation 1 gave length at birth of ~80 cm which is biologically impossible.

Equation 2: $L_t = L_\infty-(L_\infty - L_0)e^{-kt})$

Equation 1 was used for comparing growth between areas and other studies as this is the most common form in which length at age is presented for the species. Growth parameters were estimated using the least square method. A modified analysis of the residual sum of squares (ARSS) was used to compare the von Bertalanffy growth functions among locations and sexes (Haddon 2001).

Spatial variations in age structure

We compared the age distributions of fish sampled with respect to area of capture (west and east of longitude 158°E) and time of year (summer – September through to March) and winter (April through to August) for all fish combined and for sexes separately for the fish we sampled. These divisions were chosen based on the extended spawning period of swordfish over the summer period (Young et al 2003). The spatial division distinguished fish caught on the inshore seamounts and East Australia Current from fish caught to the east which were generally associated with colder water over the Lord Howe Rise (Ridgeway, CSIRO unpublished).

Age – length key

Age-length keys were developed for the eastern fishery using our sample of aged fish. Age-length keys give the proportion of fish at age in each 10-cm length class, allowing the conversion of catch-at-length data to catch-at-age. However, although swordfish are sampled routinely for weight via port sampling (Williams 1997), length measurements are scarce, primarily due to the fact that only trunks are brought to shore. We therefore converted weight to length (OFL) using the conversion: $L = (W / a)^{1/b}$ where a = 2.1355×10^{-5} and b= 2.902 for the eastern AFZ (Campbell and Dowling 2003). Catch in numbers-at-length (by 10-cm OFL class) for each annual sub-sample was separated into sex using a sex-ratio algorithm for the region (Young et al 2003). As the function only described sex ratios for swordfish between 80 – 190 cm OFLs, a plausible ratio of 0.5 was applied to fish in length classes <80 cm, and all fish >190 cm were deemed female (Turner *et al* 1996, Stone and Porter 1997, De Martini *et al* 2000, Wang *et al* 2003). Sex-separate age-length keys were then developed for each year by applying the distribution of ages per length class from the pooled-sex length-age key. The combined length-age key was selected as the most appropriate for the purpose of aging the catch at size (Megalofonou *et al* 1990) as higher sample sizes for each length class created a more robust dataset. The sum of male and female fish per age class was subsequently converted to a proportion of age for the total sub-sample for that year.

6.1.4 Results

Sample collection

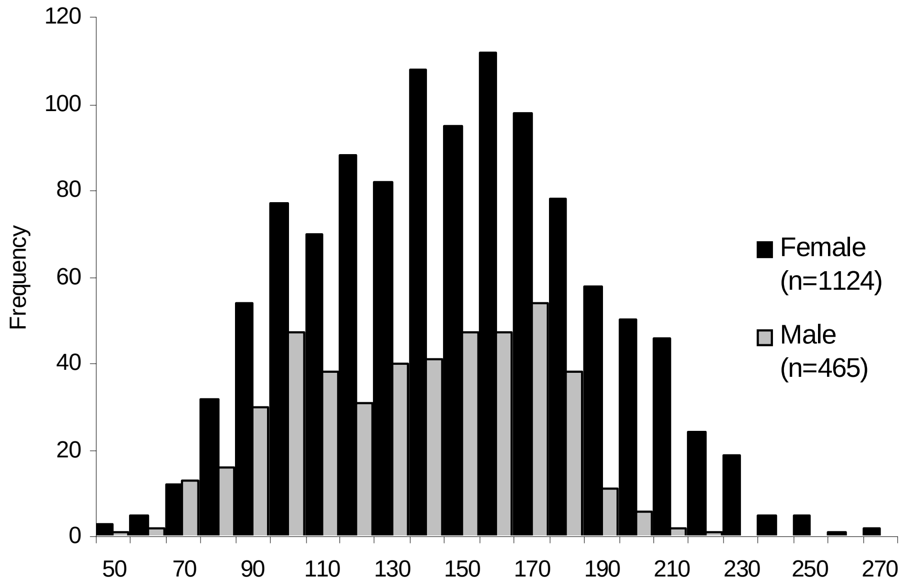
A total of 1589 anal fin rays were collected from swordfish taken in waters off eastern Australia by the domestic longline fishery. Samples were collected between 1995 and 2003 with the majority collected after 2000 (Table 1). Of the fin rays collected, 1511 could be confidently read with 79 (4.97%) unreadable (confidence =5) (Table 1). The

Table 1. Broadbill swordfish anal fin ray samples collected from eastern Australian waters from March 1995 to February 2003 (n= number collected, OFL=orbital fork length in cm)

Year	Month	Female			Male			Total
		n	OFL (min)	OFL (max)	n	OFL (min)	OFL (max)	
1995	July	9	114	191				9
1995	Mar	1	147	147	1	144	144	2
1997	Aug	23	97	212	10	132	202	33
1997	July	34	102	209	11	104	200	45
1999	Dec	34	109	263	7	116	177	41
1999	Nov	20	101	234	8	96	198	28
1999	Oct	38	109	237	24	102	192	62
2000	Dec	3	110	213	8	101	175	11
2000	Feb	92	99	233	46	100	207	138
2000	May	17	95	210	15	101	171	32
2000	Sep	105	88	270	41	95	195	146
2001	Aug	14	74	185	12	76	175	26
2001	Dec	14	97	230	8	76	170	22
2001	Feb	5	97	160	4	67	180	9
2001	Jan	39	73	242	24	82	183	63
2001	July	7	73	174	3	73	78	10
2001	Mar	30	99	216	20	78	191	50
2001	Nov	47	85	258	7	127	178	54
2001	Oct	40	130	215	4	135	150	44
2001	Sep	4	185	225	1	195	195	5
2002	Apr	29	52	225	10	52	227	39
2002	Aug	72	62	224	17	78	184	89
2002	Feb	65	80	253	26	84	195	91
2002	Jan	65	50	255	36	76	211	101
2002	July	26	93	233	7	77	188	33
2002	June	48	95	276	10	110	186	58
2002	Mar	58	57	243	31	75	184	89
2002	May	67	79	218	21	61	187	88
2002	Nov	59	70	226	22	77.5	205	81
2002	Oct	48	92	219	23	90	210	71
2002	Sep	7	138	225	1	142	142	8
2003	Feb	4	171	185	7	148	185	11
Total		1124			465			1589

number of females to males sampled was 1064: 447 males (an overall sex ratio of 1m:2.38f). The fish examined ranged in length from 50 to 276 cm (OFL) (female length range 50 to 276 cm OFL; male length 52 to 227 cm OFL) (Fig. 4) and were sampled from all months of the year when collections from all years were combined.

(a)



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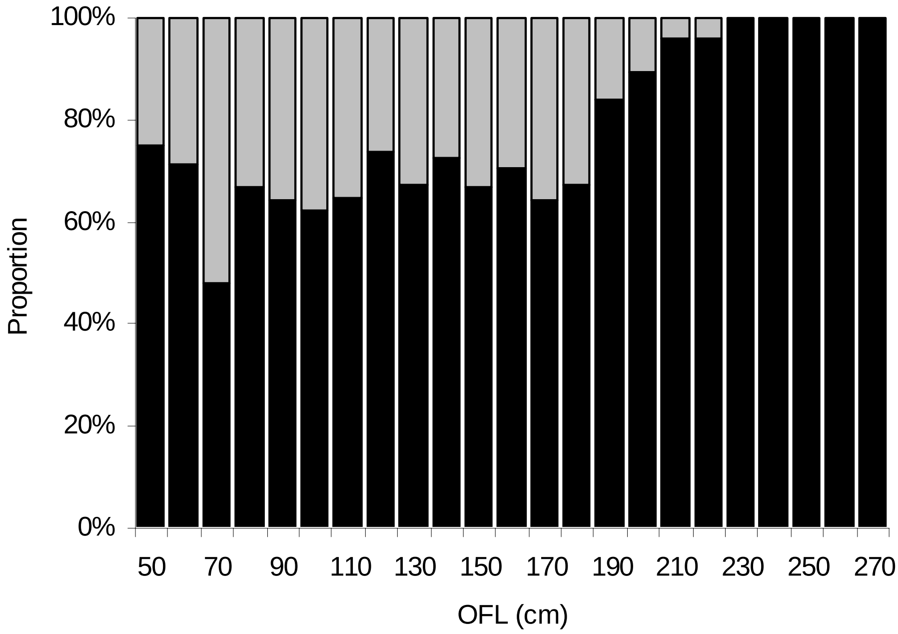
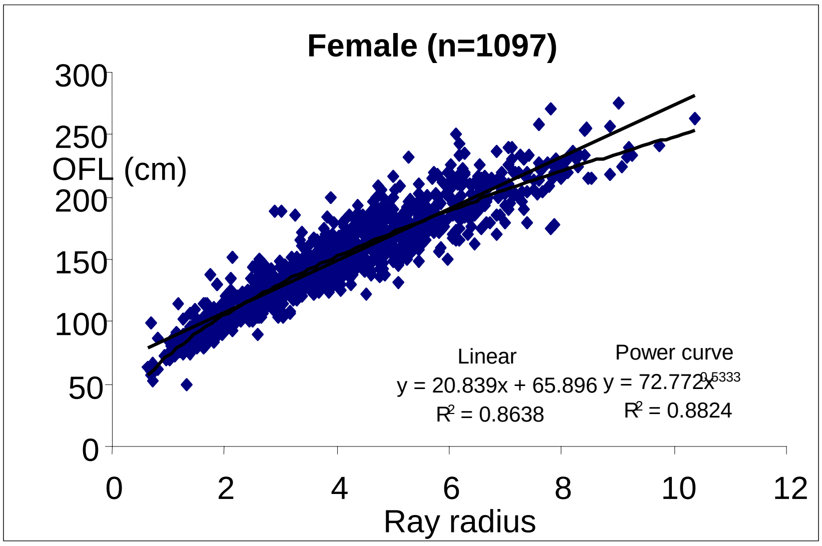


Figure 4: The size-frequency distribution (a) and proportions (b) of male and female swordfish per 10 cm size class collected from the eastern Australian longline fishery between 1995-2003.

Description of anal fin ray

A significant relationship between the radius of the second anal fin ray and fish length for both male and female swordfish indicated that rays grew isometrically with fish length and therefore could be used as a proxy for fish length (Fig. 5). Transverse sections taken above the condyle of the fin ray showed a sequence of alternating hyaline and opaque bands as viewed by reflected light (see Fig. 3).



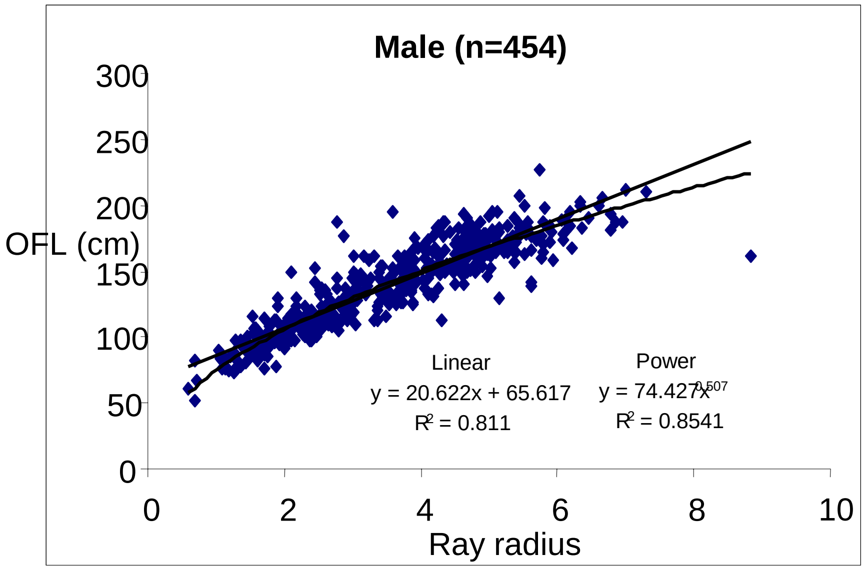
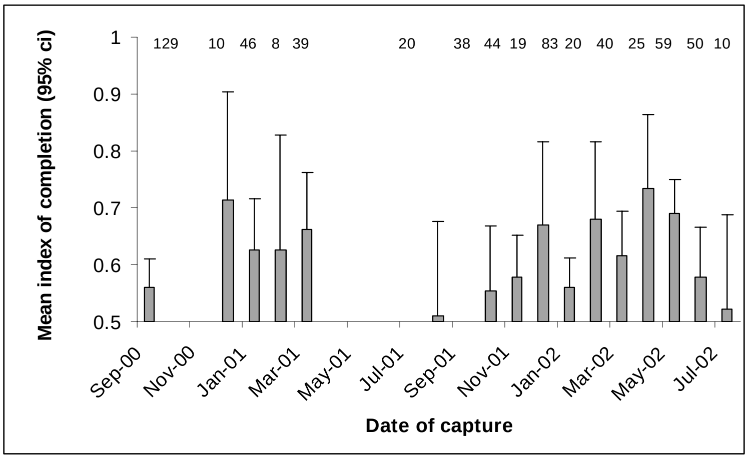
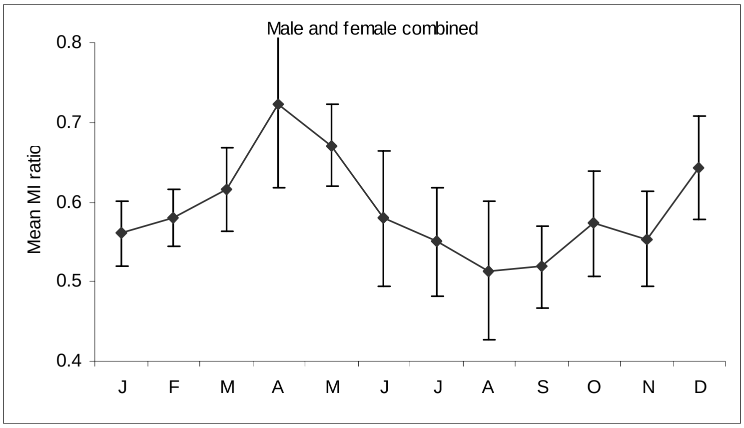


Figure 5: Anal fin ray radius (mm) in relation to length (orbital fork length, OFL, cm) for female and male swordfish

(a)



(b)



(c)

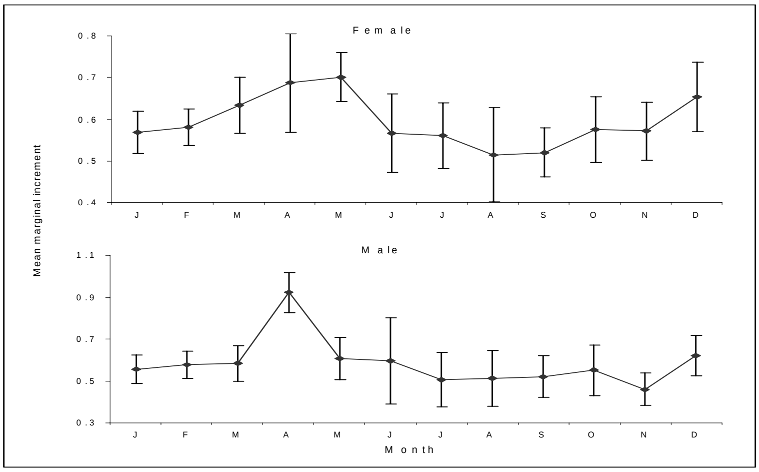


Figure 6: Mean index of completion of the last fin ray annulus of swordfish sampled over the study period using all fin rays regardless of clarity (a, sexes combined, years separated; b, sexes and sampling years combined; c, female and males separated, years combined) (n=numbers of samples per month)

Validation of annuli

1. Marginal Increment Analysis (MIA)

The pattern of completion of the marginal increments of swordfish fin rays showed that increments began forming in July or August in both years in which fin rays were collected (Fig. 6a), although no samples over the winter of 2001 limited further clarification of the time of increment formation. When all MIA measurements were grouped by month of capture (regardless of year of capture), an annual cycle in the ratio of the last to the penultimate band was observed indicating that bands were laid over a yearly cycle (Fig. 6b)(Anova, $P<0.05$). Marginal increments rose to a maximum in autumn and were at their lowest over winter and spring although there was variation between months. The maximum ratio between the last to the penultimate increment occurred in autumn for both sexes: the minimum following immediately after in winter - June for males and August for females (Fig. 6c, Table 2). This cycle was only significant for females (Table 2), although when only sections were used that had a high confidence score (confidence scores 1 and 2 combined) the MIA for males also showed a significant difference between months (Anova, $P<0.05$).

Table 2 Results of single factor ANOVA examining mean marginal increment ratio to month for all ages combined, age 2-5 inclusive and age 6-10 combined.

	Female			Male		
	df	F	P	df	F	P
All ages combined	11	2.49096	0.00454	11	1.33965	0.20251
Age 2	8	0.76972	0.63186	9	0.53898	0.82657
Age 3	10	1.20085	0.31136	11	2.64432	0.03786
Age 4	10	1.95845	0.05135	9	1.75471	0.17971
Age 5	11	0.79287	0.64622	9	0.54504	0.83377
Age 6-10	11	1.73774	0.06397	11	0.69423	0.74192

When age classes were examined separately, the highly variable nature of the marginal increments, and the lack of samples from some months resulted in very few classes that showed significant differences between months (female age class 4 and male age 3) (Table 2, Fig. 7).

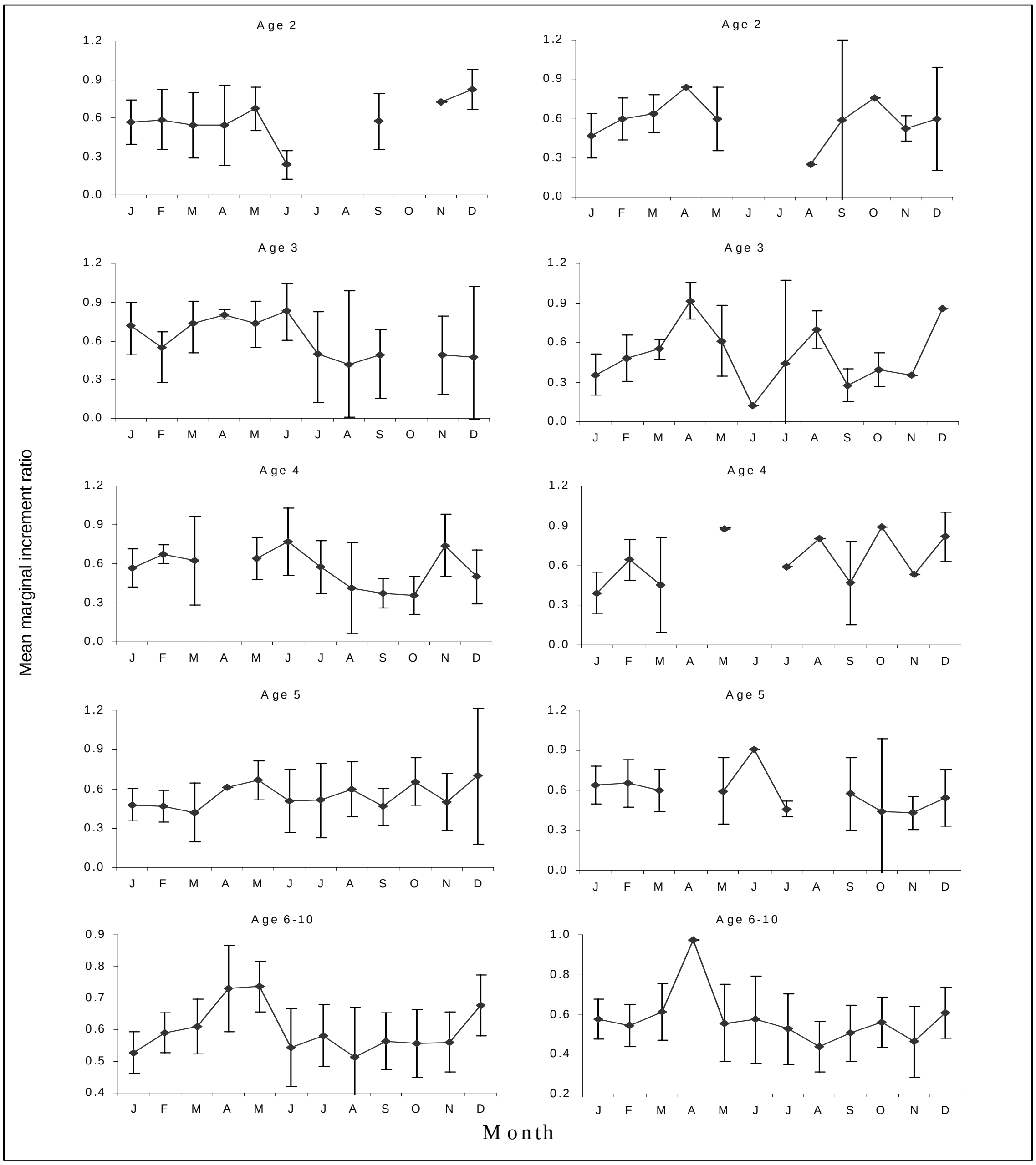
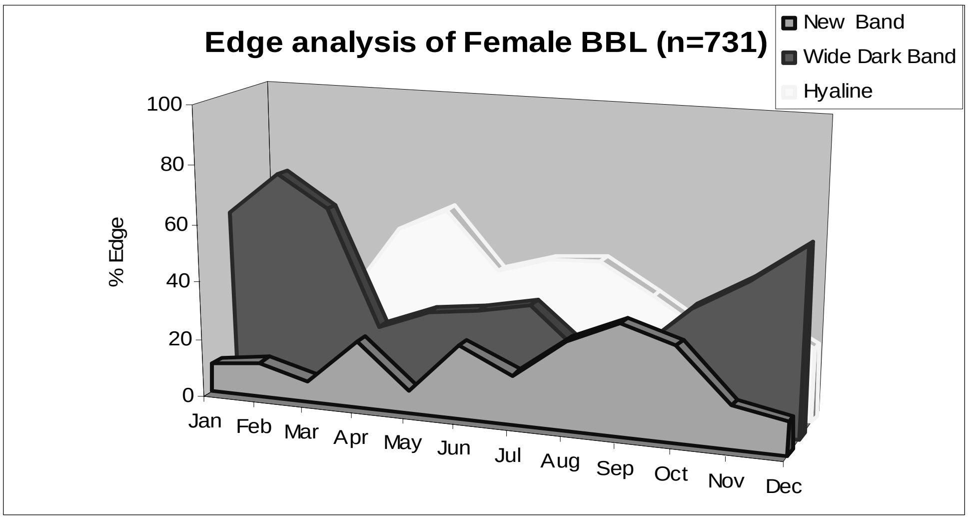


Figure 7: Mean (+-95%CI) marginal increments in relation to time of year for female and male swordfish for age classes 2,3,4,5 and 6-10yr combined

2. Edge Type Analysis (ETA)

Because of the difficulties we encountered in determining at which point to measure the outer increment of the ray-- in some sections it was not clear whether the inner margin of the outer increment was properly identified -- we attempted the more subjective interpretation of ETA. The resulting pattern for the age groups combined showed, although still variable, a clearer pattern of how the rays were formed. Hyaline edges formed mainly from May through to September in both sexes. New opaque bands were present mainly in spring and were replaced by wide opaque bands over summer (Fig. 8).



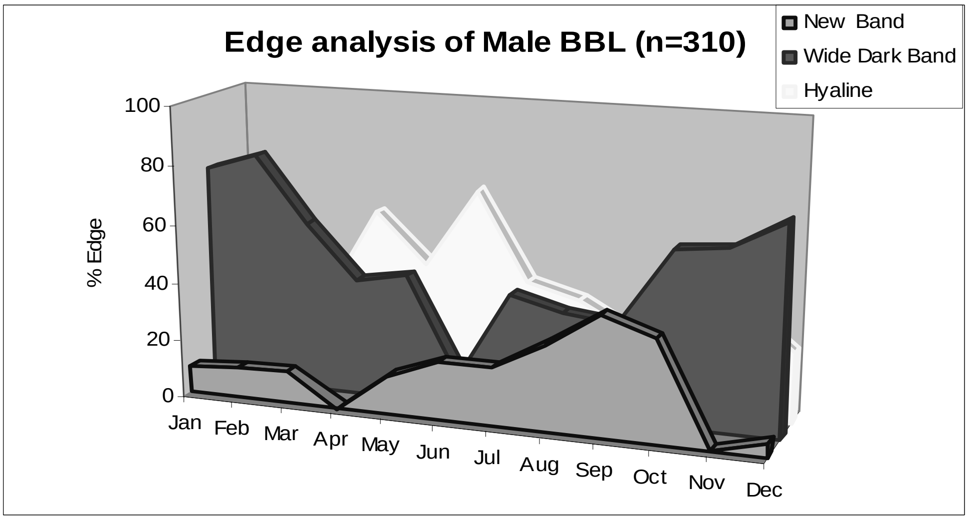


Figure 8: Edge type analysis showing the development of hyaline bands in autumn followed by new bands in spring and bands nearing completion progressively over summer

3. Logistic method

Because validation of the fin ray annuli was a central objective of the project, we tested a further method to distinguish a cycle of annulus formation in the fin rays (Peterson and Hall 2003). This method relies on joining two linear relationships fitted subjectively to the individual data by age class, and then attempting to link them through a logistic equation (Fig. 9). The steepness of the logistic equation reflects the

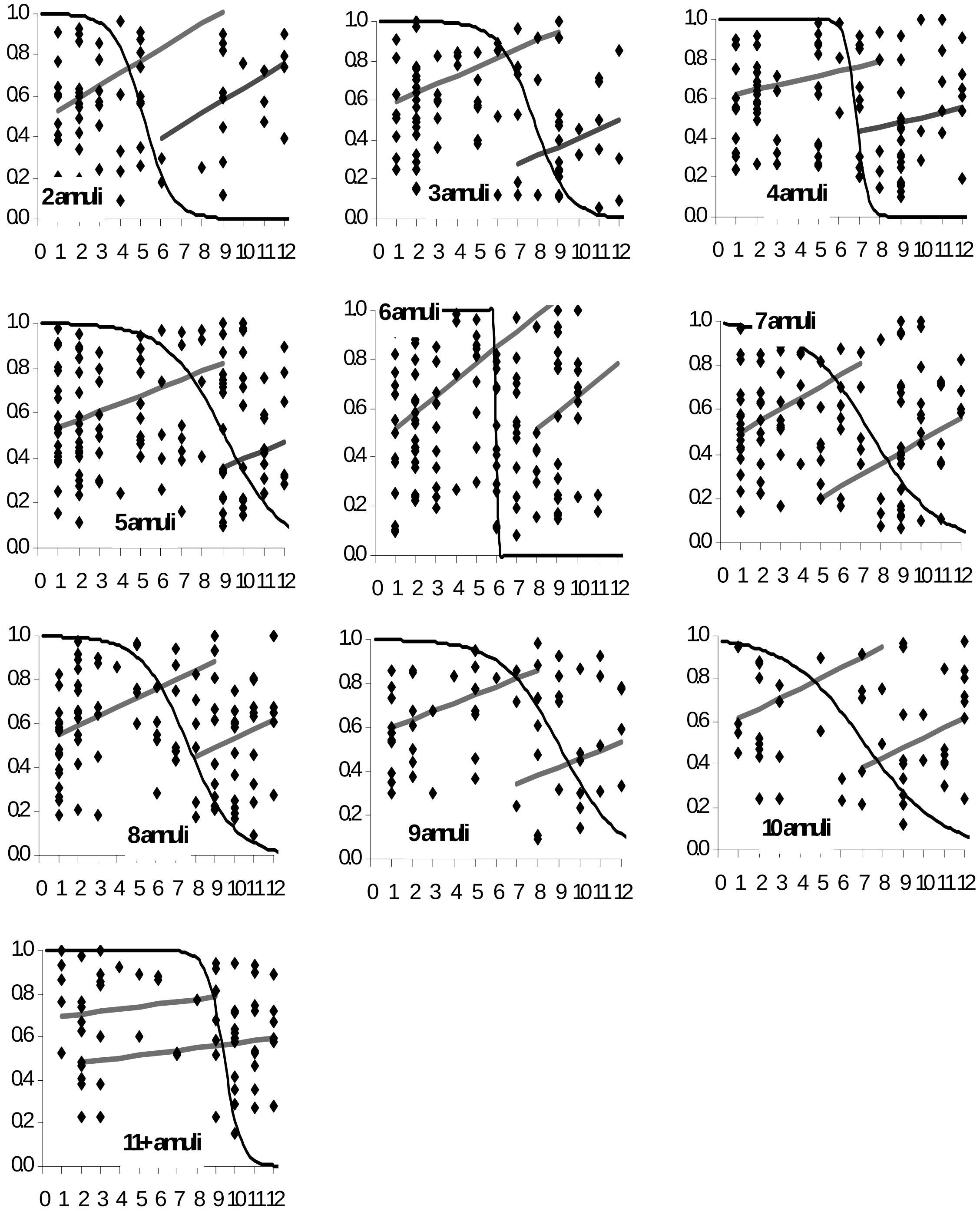


Figure 9: Marginal increment (MI) ratios of swordfish fin rays by year class with fitted logistic curves linking linear relationships of MI versus time of year. The linear relationships were limited to periods of pre and post annulus formation suggested by the raw data (following Peterson and Hall 2003)

time at which new increments were formed. Age classes 2, 4 and 6 showed clear transitions around June and July. Conversely, the age class 10 showed a very broad fit reflecting either a broader transition time or that annulus formation was not clearly defined with respect to time of year. Although there was significant individual variation in MIAs within and between months, and between year classes, this method supported the earlier overall result that annuli were completed mid year.

The combination of these investigations, although not conclusive for each age class, showed that annulus formation was completed over a range of months overlapping the Australian winter. We considered this outcome sufficient to allow us to proceed to the development of an age length relationship and an age length key for swordfish from eastern Australian waters.

Precision of readings

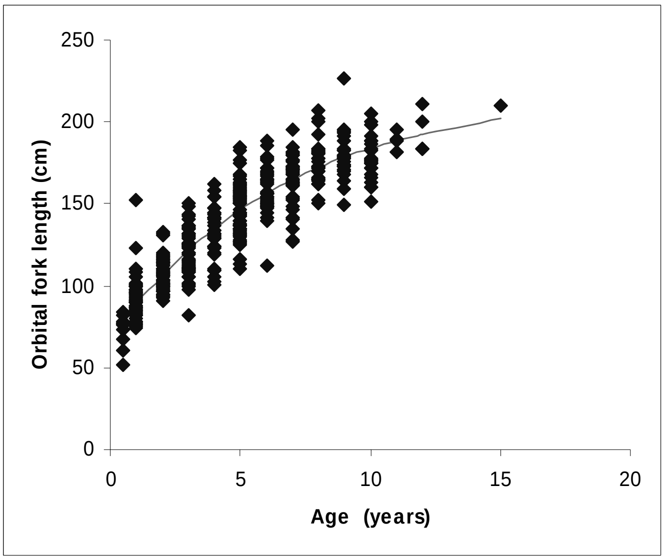
The average percent error (APE) between consecutive readings of fin ray sections for all samples was 8.35% (APE for female swordfish = 8.37%; APE for males = 8.30%). A further two comparisons were made. The first comparison was made between two readers, one from CSIRO and one reader independent laboratories and although little can be drawn from such a small sample there is obvious differences in band interpretation that underline the potential for differences in resulting growth curves. Both these readings showed divergence although the completed reading of all samples fell within the limit of 10% considered reliable.

Age and Growth

Significant individual variations in age at length were detected within all length classes for both sexes (Fig. 10, Tables 3 and 4). There was no significant difference between male and female length at age up to year 9. Beyond this age length at age was significantly different between males and females with the latter showing accelerated growth ($P<0.05$). The oldest female examined from the ETBF was 18 years old; the oldest male was 15 years old. Fifty one percent of the females sampled were ≤ 5 years old, 91% were ≤10 years old with only 9% > than 10 years old. Sixty one percent of males sampled were ≤ 5 years old; 98% were ≤ 10 years old (Table 4).

Von Bertalanffy curves fitted to length-at-age for each sex gave growth parameters of $L\infty$, K and t_o of 296.0, 0.08, and -3.7 respectively for females and 224.2, 0.13 and -3.0 for males. The growth curves were significantly different between sexes. Swordfish grew rapidly in the first year to ~75 cm OFL (Table 4) after which mean growth rate of females was ~11.3 cm per year up to year 10; male growth rate was slightly less for the same period (10.2 cm per year).

(a)



(b)

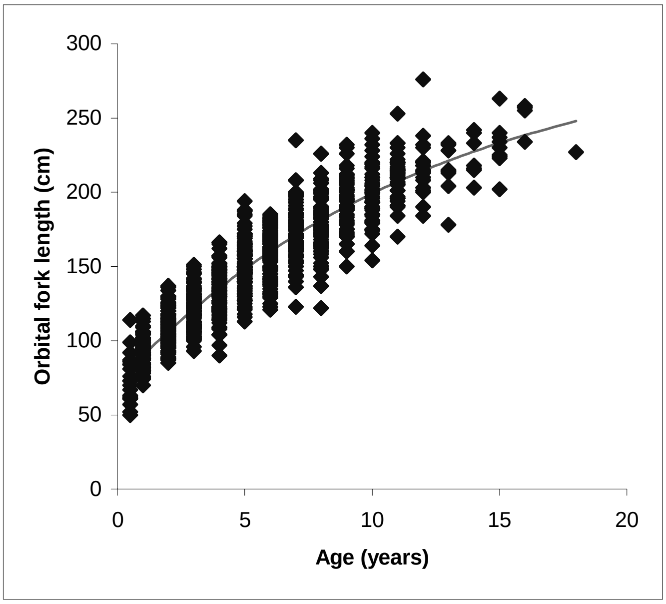


Figure 10: Data and fitted Von Bertalanffy growth curves for male (a) and female (b) swordfish from the Eastern tuna and billfish fishery

Table 3: Age-length keys for male and female broadbill swordfish from the Eastern Tuna and Billfish fishery (numbers are totals of individual in each age/size class)

FEMALE	Age class (years)																	
OFL class (cm)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	Total
50	3																		3
60	5																		5
70	4	8																	12
80	5	22	5																32
90	2	23	24	2	2														53
100		14	31	21	8														74
110	1	4	26	24	9	3													67
120			12	32	28	8	4	1	1										86
130			5	15	29	16	11	1	1										78
140				7	34	34	15	5	3										98
150				2	13	29	27	11	5	1	1								89
160					4	20	37	25	14	4	1								105
170						10	27	21	17	13	5	1		1					95
180						5	10	15	24	10	9	1	1						75
190						1		9	13	13	9	8	1						54
200								3	7	11	9	8	4	1	1	1			45
210									1	6	7	17	6	3	3				43
220									2	1	3	6	5	1		3		1	22
230								1		2	2	3	3	2	1	3	1		18
240											1				2	1			4
250												1					3		4
260																1			1
270													1						1
Total	20	71	103	103	127	126	131	92	88	61	47	45	21	8	7	9	4	1	1064

MALE	Age class (years)																	
OFL class (cm)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	Total
50	1																		1
60	2																		2
70	6	7																	13
80	2	13		1															16
90		15	13	1															29
100		8	24	10	5														47
110		1	17	13	2	3	1												37
120		1	1	14	7	5		2											30
130			3	9	8	17		1											38
140				4	10	14	8	4		1									41
150		1		1	3	21	14	3	2	1	1								47
160					1	8	8	12	7	2	5								43
170						2	6	13	10	11	10								52
180						2	2	6	7	6	5	3	2						33
190								1	1	4	2	1							9
200									3		2		1						6
210													1	1					2
220										1									1
Total	11	46	58	53	36	72	39	42	30	26	25	4	4	1					447

Table 4: Mean length-at-age of broadbill swordfish sampled from the eastern tuna and billfish fishery off eastern Australian

Age class	Total	Female	Male
1	74.6 (4.6)	75.4 (6.4)	73.0 (5.6)
2	92.9 (1.9)	93.9* (2.5)	91.4 (2.9)
3	109.2 (1.7)	109.5 (2.1)	108.4 (2.8)
4	123.4 (2.5)	124.4* (3.1)	121.5* (4.2)
5	135.4 (2.4)	136.3* (2.9)	133.1* (4.6)
6	148.7 (2.3)	150.3 (3.0)	145.7 (3.2)
7	159.9 (2.5)	160.3 (2.7)	158.1 (6.0)
8	170.5 (2.8	172.0 (3.5)	166.5 (4.4)
9	175.2 (3.1)	175.0 (4.2)	175.6* (3.9)
10	186.0 (3.7)	191.7# (4.4)	176.0# (4.6)
11	191.7 (4.4)	196.0# (5.3)	180.6# (5.3)
12	206.8 (3.8)	208.6# (3.6)	189.8# (7.8)
13	211.2 (8.1)	214.5# (9.2)	196.6# (9.4)
14	217.3 (8.8)	219.4 (8.6)	195.0 (-)
15	224.9 (9.9)	224.9 (9.9)	
16	223.0 (11.5)	224.2 (12.4)	210.0 (-)
17	235.2 (25.5)	246.8 (15.2)	189.0 (-)
18			
19	227.0	227.0	
Sample	1413	1000	413

Spatial variations in age structure

The mean age of sampled swordfish (sexes combined) was significantly lower in inshore waters during winter than it was in summer inshore waters (ANOVA; df 1,972; F=14.06, P<0.001; Fig. 11), summer offshore waters (ANOVA; df 1,836; F=29.78, P<0.001) or winter offshore waters (ANOVA, df 1,307; F= 8.15, P=0.005). As the "inshore" region is dominated by the warmer waters of the East Australia Current, this pattern suggests the area provides a favourable thermal region for the younger age classes, particularly in winter. There was no significant difference between other time/ area combinations for the combined sexes.

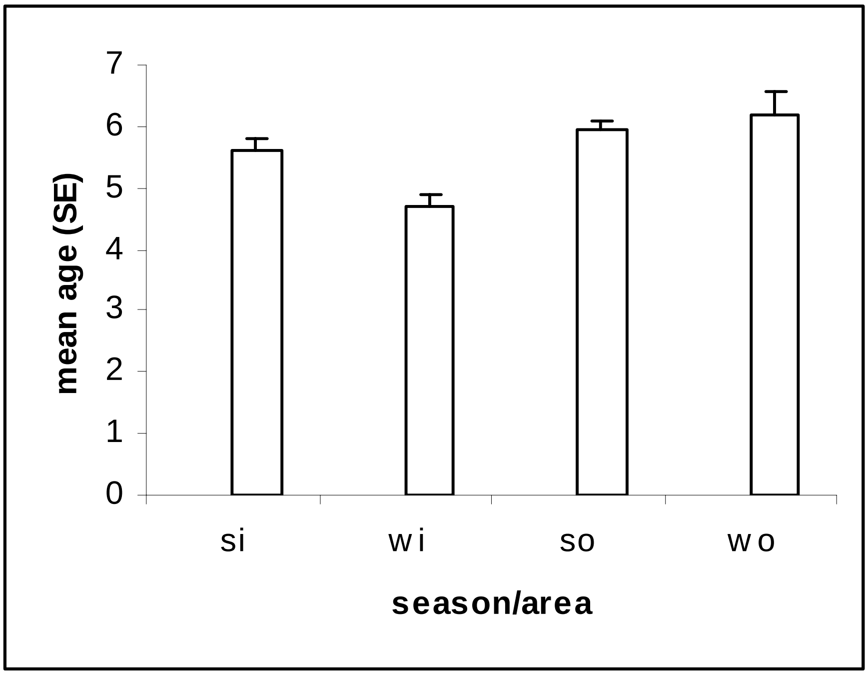


Figure 11: Mean age of swordfish sampled by area and time of year in the ETBF (si, summer inshore; wi, winter inshore; so, summer offshore; wo, winter offshore)

This pattern for the combined sexes was driven largely by the presence of smaller females in inshore waters during winter. Female swordfish were significantly younger than females taken in outside waters in summer (df =1,567; F= 22.9, P<0.001) or winter (df=1,324; F=4.69, P=0.03). Females were significantly younger in inside waters in winter than in inside waters during summer (df=1,470; F=10.72, P= 0.001). This pattern of relatively young fish in inshore waters during winter was also repeated for male swordfish underlying the importance of this region for younger swordfish.

Age structure of the eastern Australian swordfish catch

The age-at-length keys (Table 3) were applied to length frequency data to estimate the age distribution of the annual catch of swordfish from the Eastern Tuna and Billfish Fishery from 1997 to 2001. Fish aged between four and six years generally dominated the swordfish catch off eastern Australia. However, in1999 there was an increase in the proportion of 2 year old fish and in the following year one year olds in the catch suggesting a downward trend in the age of the fish taken by the fishery.

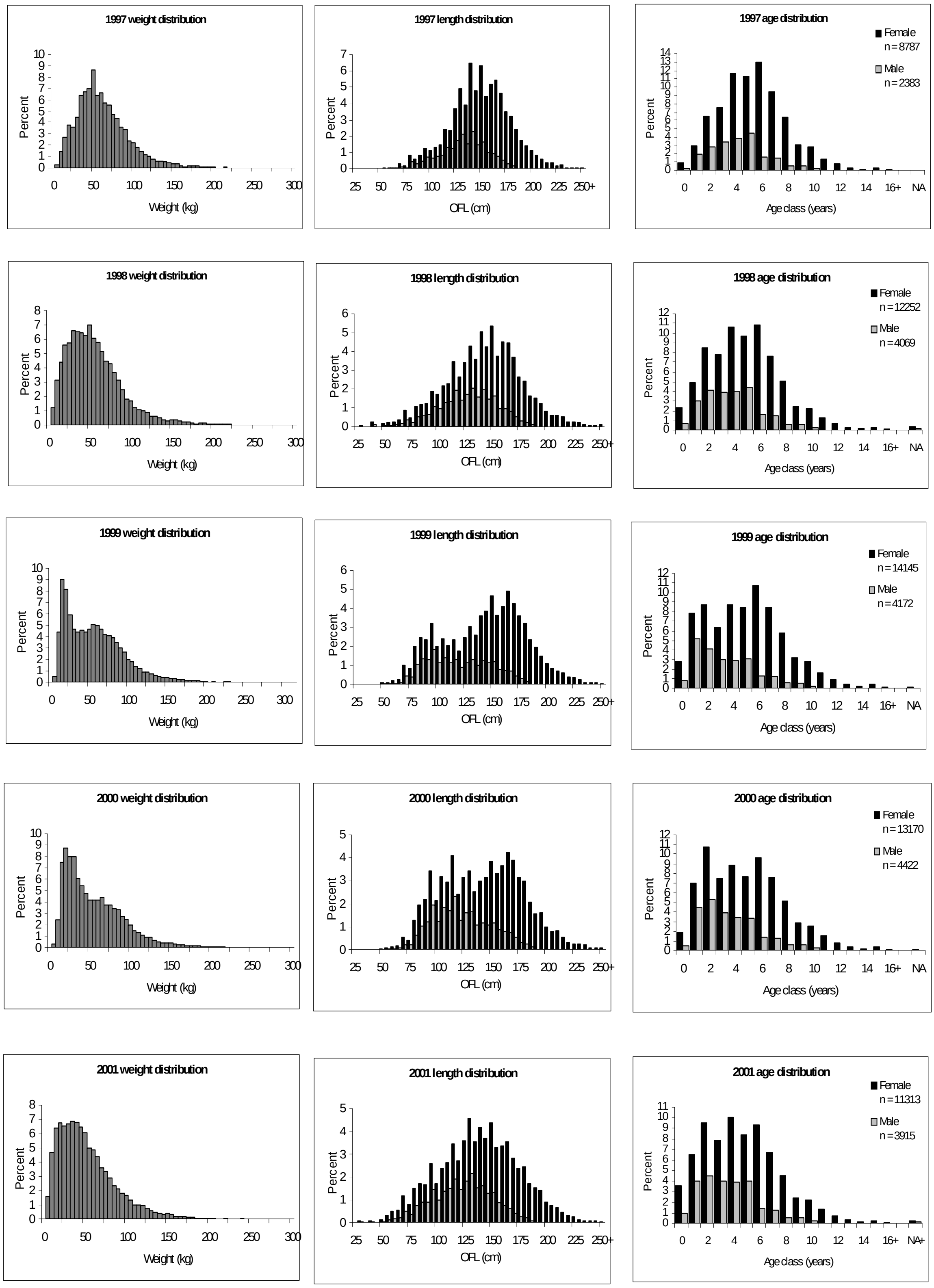


Figure 12: The weight, length and age structure of the broadbill swordfish catch taken between 1997 and 2001 off eastern Australia

6.1.5 Discussion

Indirect validation

The lack of direct validation of swordfish age estimation methods limits the ability to precisely estimate swordfish age and growth. Swordfish are relatively solitary in nature, thus mass tagging is impractical. Direct methods of validation such as tag recapture and associated methodologies such as strontium marking of hard parts have yet to be attempted (Clear et al 1999), although the viability of this method has been established for marlin (Speare 2001). There have been examples of fishery-run tagging initiatives but these have had limited success. Of the ~400 swordfish tagged and released by the ETBF only 8 have been recaptured (as at June 2004, C. Stanley, CSIRO unpublished data). The relatively high morbidity of smaller fish when captured, and the likely shedding of tags by fish once freed, has been cited as reasons for the lack of returns recorded so far.

The main focus for swordfish validation studies, therefore, has been the refining of indirect validation techniques such as marginal increment analysis (MIA) and edge type analysis (Pearson 1996). Sun et al (2002) showed significant differences between seasons in the marginal increments of swordfish from 5 year classes in the Taiwan Sea using MIA. They reported a seasonal cycle of increasing margin width relative to the last complete band initiated in winter and reaching a maximum in summer. More recent developments in the analysis of marginal increments have taken the form of fitting logistic regressions to change in the increase in the relative width of the last increment at capture as demonstrated by Peterson and Hall (2003) for four species of tropical fish and which we applied to the present data. This analysis supported our conclusion that opaque bands are initiated in winter and completed over an annual cycle.

In Chapter 6.3 we examined the relationship between daily otolith count and annulus formation which has previously provided compelling evidence for annual ring formation in some fish species (Campana 2001). However, matching daily increment deposition in otoliths with year old swordfish determined from fin rays is problematic. This is mainly due to the extended spawning period that we determined previously for swordfish in eastern Australian waters (Young et al 2003). Swordfish spawn mainly between September and March off eastern Australia. As opaque bands are deposited in the fin ray in late winter to early spring (July to September), the first annulus could have been deposited as little as two and as much as 10 months after birth. Therefore, a ray with 1 band could be from a fish that is only a few months old, or over 1 year old.

Given the lack of direct validation methods for swordfish, there has been a recent attempt to test whether laboratories involved in age estimation of swordfish using anal fin rays are actually counting the same bands (De Martini, University of Hawaii unpublished). We found initially through this comparison that we were counting a band close to the focus that other laboratories had decided was not an annual increment. This lead to us rereading a number of slides and has significantly increased our confidence in the age estimates we have given.

Growth in relation to other regions

Swordfish is a target of pelagic longline fisheries worldwide and has been the focus of many studies similar to the present one. These studies have revealed a range of growth parameters with those from the Mediterranean Sea being the most different (Fig. 13).

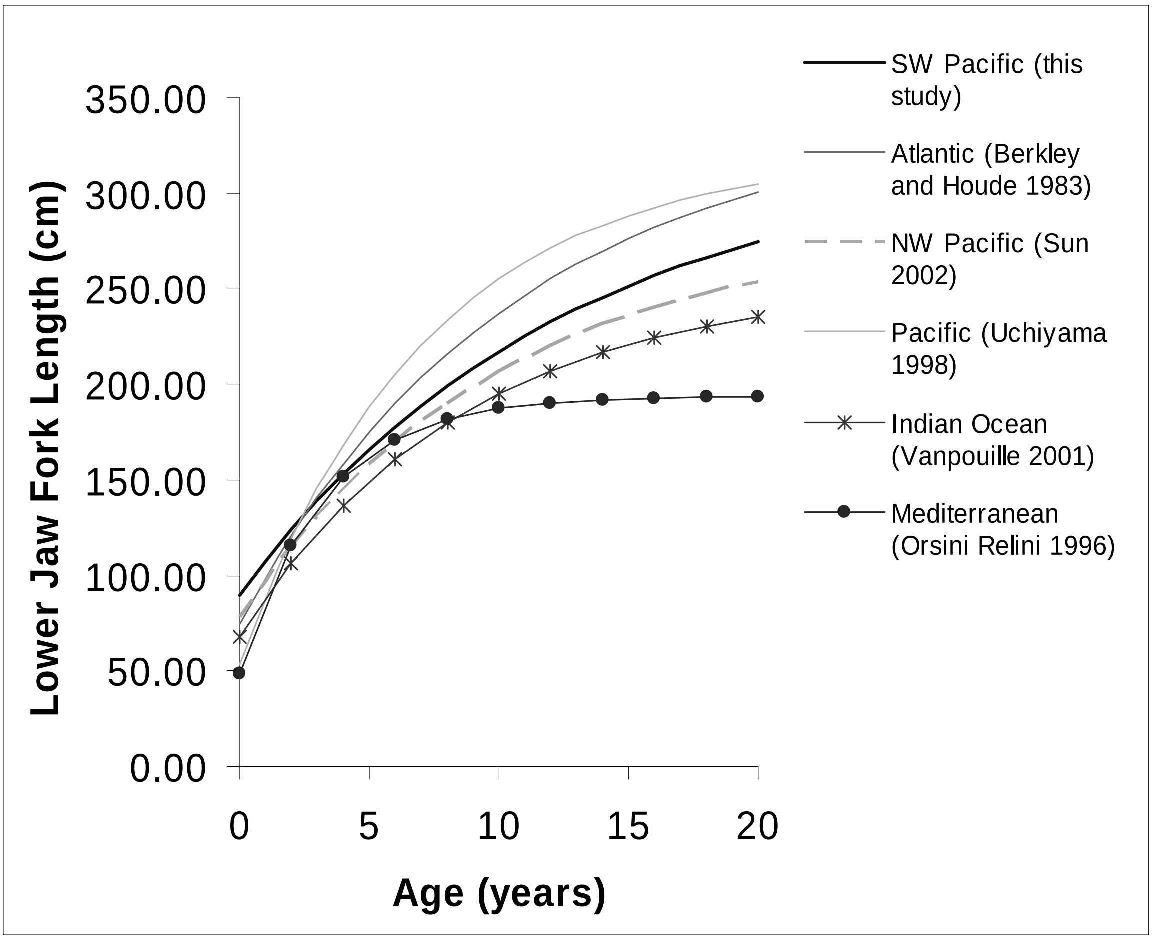


Figure 13: Standard Von Bertalanffy curves for female swordfish sampled from the Pacific, Atlantic and Indian Oceans, and from the Mediterranean Sea using anal fin rays

Comparing swordfish age and growth between, and within, regions is difficult because different age estimation techniques are used between studies. Although using anal fin rays is presently the most practical available, there is significant variability in annulus counts between individuals of similar size. Until there are dedicated studies employing mark/recapture techniques over short and long time periods, only limited progress in interregional comparisons is likely. One of the difficulties in the type of study we employed is there is a degree of subjective interpretation in what constitutes an annual band on the sectioned fin rays. We participated in a blind study initiated by de Martini et al (personal communication) from the Hawaii National Marine Fisheries Service to see whether the structures we were recording as annual rings agreed with readers from laboratories from Hawaii, Taiwan, Japan and Mexico. That study showed that we were recording an extra band near the focus of the ray not considered annual by readers elsewhere. After adjustment we consider our methods, and final readings, to be in line with those from the other participating laboratories.

Age at maturity and catch at age – implications for the fishery

In a study of the reproductive biology of swordfish from the same waters, Patterson et al (2002) found that their size at maturity was one of the largest reported for the species. The length at which 50% of the female population was reproductively active, ~200 cm OFL, was well above the median size of fish caught by the fishery. Patterson et al (2002) suggested that this may have been due to the relatively short history of fishing for the species in eastern Australian waters resulting in higher numbers of large mature female swordfish in the wild population. With more intensive fishing pressure over recent years, these larger fish have progressively been removed from the population. The concern raised by the present study is that the size at 50% maturity we reported in that study (~200 cm OFL) equates to a 10 year old female. Continuous monitoring of the size of swordfish taken by the fishery suggested that the median weight of fish has declined. When the age length key was applied retrospectively a lower median age was found as the fishery developed. In 2001 the catch was dominated by a mode of fish between 2 and 4 years old whereas in 1997 the catch was composed mainly of 4 to 6 year old fish. Assuming that there would be little change in the age length relationship for fish caught in 1997 our results show that the median age of fish taken by the fishery has dropped significantly from when the domestic fishery first began (Fig.12). Whether this reflected a recruitment pulse or was the result of overfishing has yet to be determined, although the decline in the proportion of older age fish in the catch is similar to swordfish fisheries elsewhere where fishing impacts have been reported (Anon. 2003).

In the North Atlantic swordfish fishery, where restrictions are now in place to protect the young of the year, there is evidence of replenishment of the mature age fish to the fishery. This initiative came after catches had decreased by almost half between 1988 and 1995 to an annual catch of ~6 million pounds (~3,000 tonnes). At the same time the average size of commercially caught swordfish had also declined; from 120 Kg in 1963 to ~40 Kg in 1995. More than 83% of the female swordfish and 36% of the males caught in 1995 by the domestic industry in the North Atlantic were immature, a situation analogous to that reported for eastern Australian waters (Patterson et al 2002). Off eastern Australia Patterson et al (2002) found immature female swordfish made up 77% of the catch of the females taken by the fishery. In contrast, immature males only accounted for 27% of the male catch.

The U.S. now regulates the commercial swordfish catch by limiting the number of fishermen targeting the stock and implementing seasonal and area closures to protect undersized fish. In 2001, NOAA Fisheries closed 133,000 square miles of coastal waters off the southeast U.S. coast as this area in particular was known as a regular spawning area for the species. As well there are now minimum size restrictions and quota limitations in

place. It should be noted that restricting the landing of immature fish was not in itself enough to effect the changes needed. In 1996, U.S. fishermen
discarded dead an estimated 40,000 young swordfish in the North Atlantic alone when size restrictions were first introduced [1].

Spatial variations

The comparison of the age of fish caught from inshore and offshore waters at different times of the year revealed that younger fish were consistently taken in inshore waters (west of 158° E) during the Austral winter. This is the time and area, noted previously to be where reproductive activity was concentrated off eastern Australia (Young et al 2003). In that study, it was proposed that spawning took place in waters with a sea surface temperature greater than 24°C and suggested that mature swordfish were targeting the East Australia Current to spawn. The life history strategy we reported for eastern Australian swordfish was very similar to that reported for populations of western Atlantic swordfish (Arocha 1997), and where time area closures and size restrictions appear to have been effective in rejuvenating the depleted stocks in that region (Anon. 2003)[1]

Conclusions

Marginal increment analysis was used to indirectly validate the use of anal fin rays to age swordfish for the combined age classes. However, we were unable to determine significant cycles of marginal increment for all year classes examined. A von Bertalanffy growth curve was fitted with estimated parameters of L_∞, K and t_0 of 296.0, 0.08, and -3.7 respectively for females and 224.2, 0.13 and -3.0 for males (based on orbital fork length). Swordfish caught off eastern Australia have similar length at age relationships to those reported for other regions except for the Mediterranean Sea. Swordfish taken inshore during winter were significantly younger than fish taken offshore at other times of the year. An age-length key was developed that, when applied to the catch by the fishery between 1997 and 2001, showed the average age of the catch by the fishery has decreased significantly since the domestic fishery started. This result, taken together with the reported decrease in catches of swordfish off eastern Australia (Campbell 2002b), underline the need for more stringent management procedures for the fishery.

6.1.6 Acknowledgements

This study was supported enthusiastically by the skippers, managers and processors of the Eastern Tuna and Billfish fishery. We are also grateful for the advice and knowledge shared by members of the CSIRO Pelagic Fisheries and Ecosystems Research Group, particularly Dr Natalie Dowling.

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[1](http://www.nrdc.org/wildlife/fish/rnasword.asp;

http://www.useu.be/Categories/Trade/Fisheries/Oct1402SwordfishRecoveryAssessmentNOAA.html

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6.2 A preliminary investigation of age and growth of swordfish, *Xiphias gladius*, from Western Australian waters using anal fin rays

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6.2.1 Abstract

This study provides the first estimate of age and growth of swordfish from western Australian waters (eastern Indian Ocean), and includes a comparison with that of swordfish from eastern Australian waters (western Pacific Ocean). Samples were collected between 1997 and 2003 by observers aboard commercial longline vessels operating out of four Western Australian fishing ports. Age was estimated using cross-sections of the second anal fin ray of 188 swordfish (122 females and 66 males) of known orbital fork length. Trends in the marginal increment ratio and percent edge type per month indicated that growth bands formed once a year. Length-at-age data were applied to the standard von Bertalanffy growth equation for each sex, with the following parameters; for females L_∞ = 296.51, k = 0.1096, t_0 = -3.0118, for males L_∞ = 236.90, k = 0.0815, t_0 = -3.0148. No consistent differences in mean length were detected between males or females aged 1 – 9 years from the Indian and Pacific Oceans (P>0.05). Fish aged between three and seven years generally dominated the SWTBF catch, with no trend evident in median age class over the study period.

6.2.2 Introduction

The domestic longline fishery off Western Australia has expanded rapidly since the exclusion of Japanese longliners from the Australian Fishing Zone (AFZ) in 1998. Broadbill swordfish, *Xiphias gladius,* are now the target species for most Southern and Western Tuna and Billfish Fishery (SWTBF) operations. Annual landings peaked at 2136 t in 2001 from 224 t in 1998, surpassing the largest annual catch by the longer-established Eastern Tuna and Billfish Fishery (ETBF) (Lynch 2004). However, catches have recently declined to below 2000 tonnes in 2002 (Lynch 2004).

Several swordfish fisheries in other parts of the world have reported initial rapid expansion before declining (Ward and Elscot 2000). Significantly, eastern Australian catches of swordfish have declined notably over the past five years despite an increase in fishing effort (Campbell 2002). With concern over the sustainability of swordfish stocks within the Australian Fishing Zone (AFZ), there is a need to undertake rigorous population assessments that will directly contribute to the development of rational management strategies (Clear *et al* 2000).

Information on the age and growth of swordfish stocks are critical for any age-structured stock assessment model. Similarly, knowledge of stock structure and mixing rates are important as fish from genetically distinct stocks may have different biological characteristics (e.g. growth rates) and thus respond differently to fishing pressure (Ward and Elscot 2000). Estimated growth rates of swordfish vary between different oceanic regions (Chapter 6.1). However, genetic studies have been unable to distinguish between the swordfish occurring off western Australia (eastern Indian Ocean) and eastern Australia (western Pacific Ocean) to date (Reeb *et al* 2000, Ward *et al* 2001). Nevertheless, a comparison of the age structures between both populations may help elucidate differences in the stocks as a result of fishing practices, with implications for management.

Previous age determination studies of swordfish have indicated a preference for counts of annuli in cross-sections of the second anal-fin ray due to the practicability of collection, processing and analyses (Berkeley and Houde 1983, Tsimenides and Stirpes 1989, Esteves *et al* 1995, Clear *et al* 2000, Sun *et al* 2002). The validity of this approach lies in the assumption of periodic consistency in band formation. Growth bands are often assumed to be annual in nature; however Ehrhardt (1992) and Sun *et al* (2002) were able to achieve an indirect validation of the anal-fin technique through marginal increment analysis. Accordingly, before an accurate stock assessment can be commenced, validation must be undertaken for the aging technique employed.

The primary goal of this study was to provide a preliminary description of the age and growth of swordfish in the eastern Indian Ocean within the western AFZ using anal-fin rays. Results of these analyses were also compared with the data of Young *et al* (Chapter 6.1) of swordfish samples within the eastern AFZ to determine whether stock/catch characteristics between the fisheries differed significantly. A second objective was to determine the age structure of swordfish catches by domestic longline in the western AFZ. As such, age-length keys were applied to sub-samples of annual catch-at-length data for the fishery. Any variations between the catch structure of SWTBF and ETBF catches were investigated. These objectives provide a fundamental step towards the development of operational models required for swordfish in the southern and western AFZs. The results of this study can be used as a prelude to further evaluation of the swordfish stock in western Australian waters.

6.2.3 Methodology

Collection and preparation of samples

Swordfish were sampled opportunistically by either trained observers or longline crews aboard commercial fishing vessels operating out of Albany, Geraldton, Fremantle and Esperance, Western Australia (Fig. 1).

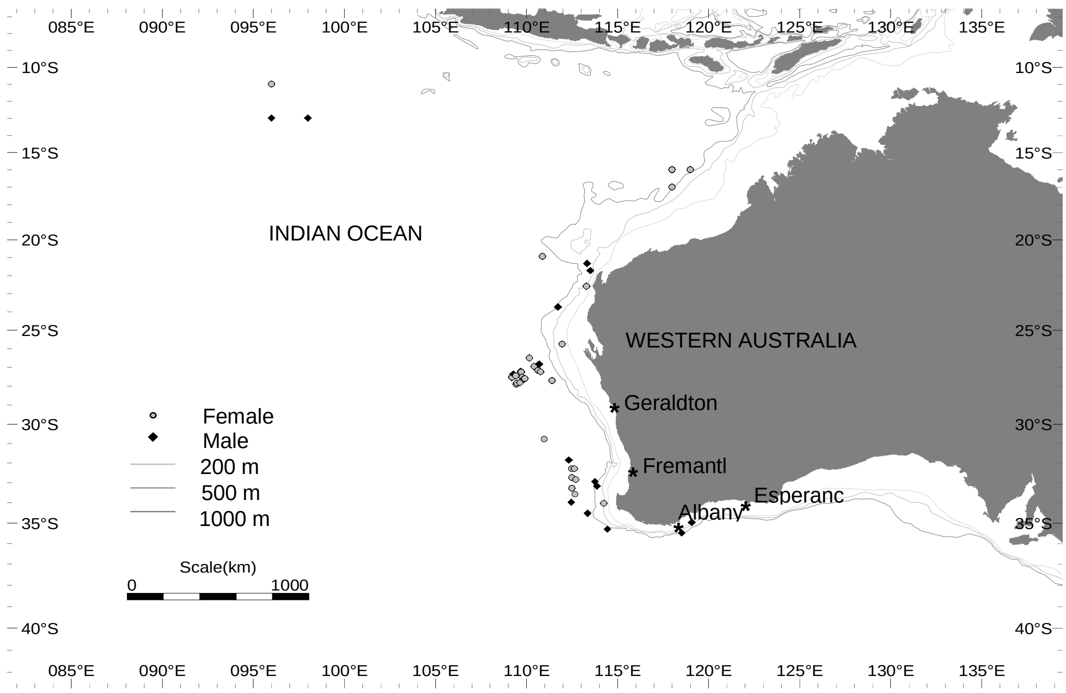


Figure 1: Map of Australia showing swordfish fishing ports, fishing grounds and where male and female samples were collected.

A total of 188 (122 female and 66 male) swordfish were sampled from various months between 1995 and 2003, however most were collected from July to September when the majority of catches occur (Ward *et al* 1996, Campbell and Taylor 2000) (Table 1).

Table 1: Composition of swordfish samples according to month (A) and year (B) of capture.

A

Month	Female	Male	Total
January	-	-	-
February	8	19	27
March	-	-	-
April	6	3	9
May	7	1	8
June	8	6	14
July	35	16	51
August	11	8	19
September	28	8	36
October	-	-	-
November	19	5	24
December	-	-	-
Total	122	66	188

B

Year	Female	Male	Total
1995	8	19	27
1997	9	8	17
1999	4	2	6
2002	19	5	24
2003	82	32	114
Total	122	66	188

For each fish, the gonads and first anal fin were removed and labeled with sex, orbital fork length (OFL – straight distance from the eye to the fork of the caudal fin) and date of capture. Samples were frozen and transported to the laboratory where sex was confirmed by stereomicroscopic examination of the gonads. Anal fins were thawed and boiled to remove the bilaterally-paired second ray, which was subsequently cleaned of tissue and split in two. Sections from each ray were processed following the methodology outlined in Chapter 6.1.

Age determination and marginal increment readings

Anal fin ray sections were viewed at 6X, 12X or 25X magnification with transmitted light using a stereomicroscope fitted with a digital camera and run with AnalySIS computer software. Distance calibrations were incorporated for each magnification setting. Video images (1040 x 772 pixels) of the clearest section/s of each ray were stored on computer. Each ray section was aged according to the number of paired opaque and hyaline bands visible, taking into account the possible disappearance of the first annulus in larger sections (older fish) and the presence of multiple (false) bands (Berkeley and Houde 1983, Tserpes and Tsimenides 1995, Ehrhardt *et al* 1996) (Fig. 2). As in Young *et al* (Chapter 6.1.), readings were assigned a confidence score of 1 to 5 (Table 2). Images were read at least twice at an average interval of three days apart by one to three readers without reference to the life history details of the sample. Third and fourth readings were made on samples where the first two blind readings did not correspond. If a confident age estimate could not be determined, the sample was read with reference only to the previous age estimates. Samples were excluded from analysis if a final age could not be resolved or if the average confidence of the readings was >4. The precision of readings was evaluated as the average percent error index (APE Index- Beamish and Fournier 1981).

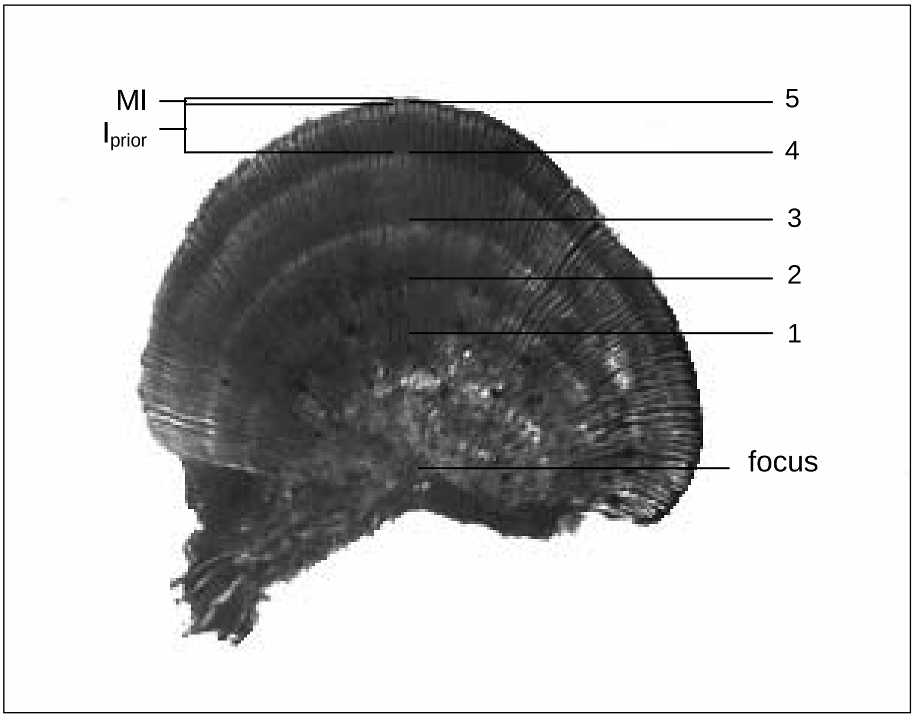


Figure 2: A typical ray section showing the marginal increment (MI), increment prior to the marginal increment (I_{prior}), and the focus. Counts are made from the beginning of each annulus. Estimated age is 5+ years.

In order to validate the reading of annuli by marginal increment analysis (MIA), the following measurements were recorded in microns using the AnalySIS software; the distance from the focus to the distal edge, the marginal increment (MI- defined by Prince *et al* 1988) width, and the width of the previous adjacent annulus (opaque + hyaline zones) (Fig. 2). As per the age determination readings, sections were read blindly and a confidence level was assigned to the accuracy of measurements taken (Table 2). Marginal increments were also assigned an 'edge type', based on the colour (hyaline or opaque) and width of the MI relative to the previous opaque zone (Table 3) (Pearson 1995).

Table 2: Readability/confidence scores assigned to age estimates and marginal increment analysis.

Readability/confidence score	Definition
1	Highly confident
2	Confident
3	Reasonably confident
4	Uncertain
5	Unreadable

Table 3: Definitions of edge types used to validate the reading of annuli.

Edge Type	Details
Narrow opaque	Opaque zone < ¼ width of previous opaque zone
Wide opaque	Opaque zone > ¼ width of previous opaque zone
Hyaline	White edge

Data Analysis

Sex ratio

Sex ratios were expressed as the proportion of females to the total number of male and female swordfish. The proportion of female samples was modeled against 10-cm OFL class to describe the relationship between sex ratio and orbital fork length for the samples collected. The measure of goodness of fit was r^2.

Marginal increment and edge type analysis

Marginal increment analysis (Berkeley and Houde 1983) and edge type analysis (ETA) (Pearson 1996) were used to ascertain the timing of increment formation. The marginal increment ratio (MIR) was estimated for each specimen according to the formula: $MIR = (S-S_n)/(S_n - S_{n-1})$ where S = ray radius, S_n = distance from the ray focus to band n, S_{n-1}= the distance from the ray focus to band n-1 (Prince et al 1988, Esteves et al 1995, Sun et al 2002). The mean MIR and the 95% confidence intervals were calculated for all samples and by sex for each month. Mean MIR's for months with sample sizes of less than three fish were removed from analysis. Owing to the small sample size, analyses of separate ages for each month were not undertaken. Tests (ANOVA and two-sample *t*-tests) for significant differences between months and seasons were performed. The critical level of significance was taken as $\alpha = 0.05$ in all cases.

Age and growth analysis

Length-at-age keys by 10-cm OFL intervals were determined for female and male samples separately and for sexes pooled. Unpaired, two-tailed *t*-tests were used to compare mean length-at-age among sexes and between Indian Ocean and Pacific Ocean data from Young *et al* (Chapter 6.1). Sample sizes of less than four individuals per age were not included in the analyses. Raw length-at-age data for each sex were applied to the standard von Bertalanffy (VB) growth equation to graphically represent estimates of theoretical growth: $L_t = L_\infty(1-e^{-k(t-t_0)})$ where L_t = the mean orbital fork length at age t, L_∞ = the asymptotic length, t_0 = the hypothetical length at age zero and k = the growth coefficient. Parameters of the VB equations for male and female samples were estimated using the least square method (Haddon 2001). Analysis of the residual sum of squares (ARSS- Chen *et al* 1992) was used to test for coincident curves between males and females from the Indian Ocean samples in this study, and between western Pacific Ocean samples obtained by Young *et al* (Chapter 6.1) following Haddon (2001).

In order to compare our growth curves to those of other authors, parameters of the VB equations were also calculated in terms of lower jaw fork length (LJFL). Original OFL data was converted to LJFL by the equation: $LJFL = 1.0559 OFL + 10.323$.

Age-composition of catch

Data from random sub-samples of the annual landed swordfish catch from the Southern and Western Tuna and Billfish Fishery were obtained from CSIRO observers aboard vessels operating out of Albany, Geraldton and Fremantle, Western Australia. Although length data was not sufficiently sampled, trunked weight (W) data was available to the nearest kilogram for the years 1999-2002. Weight was converted to the estimated LJFL, then to OFL via the following equations, respectively:

i $LJFL_{est} = (2.14^{-5}/W)^{-1/2.902}$

ii $OFL_{est} = (LJFL_{est} - 10.323)/ 1.0559$

Catch in numbers-at-length (by 10-cm OFL class) for each annual sub-sample was separated into sex using the previously resolved sex-ratio algorithm. As the function only described sex ratios for swordfish between 80 – 190 cm OFLs, a plausible ratio of 0.5 was applied to fish in length classes <80 cm, and all fish >190 cm were deemed female (Turner *et al* 1996, Stone and Porter 1997, De Martini *et al* 2000, Wang *et al* 2003). Sex-separate age-at-length keys were then developed for each year by applying the distribution of ages per length class from the previously determined pooled-sex length-at-age key. The combined length-at-age key was selected as the most appropriate for the purpose of aging the catch at size (Megalofonou *et al* 1990) as higher sample sizes for each length class created a more robust dataset. The sum of male and female fish per age class was subsequently converted to a proportion of fish per age for the total sub-sample for that year.

6.2.4 Results

Reading success, length distributions and sex ratios

Of the 188 (122 females and 66 males) anal fin rays examined, 187 (122 females and 65 males) were read successfully. Only one fin ray was considered unreadable due to indefinable annuli. The average percent error (APE) index for all blind readings performed by one to three readers was 8.94%. The average confidence assigned to age determinations was 2.9 (±0.05 SD) for all samples able to be read (n = 187).

Orbital fork lengths (OFL) of all fish sampled ranged from 67 cm to 243 cm for females and from 76 cm to 189 cm for males (Fig. 3A). The proportion of females to the total number of fish sampled varied from 0.4 to 0.8 in fish less than 190 cm OFL, after which size only females were sampled (Fig. 3B). The sex ratio for all samples was 0.65. The relationship between sex ratio (y) and orbital fork length (x) was best described by the polynomial function $y = 2E\text{-}10x^5 - 2E\text{-}07x^4 + 5E\text{-}05x^3 - 0.0069x^2 + 0.5153x - 14.662$. ($r^2 = 0.622$)(Fig. 4). Due to a lack of sufficient sample sizes below 80 cm, and the constant 1:0 ratio of females to males beyond 190cm, the data were only modeled within this range.

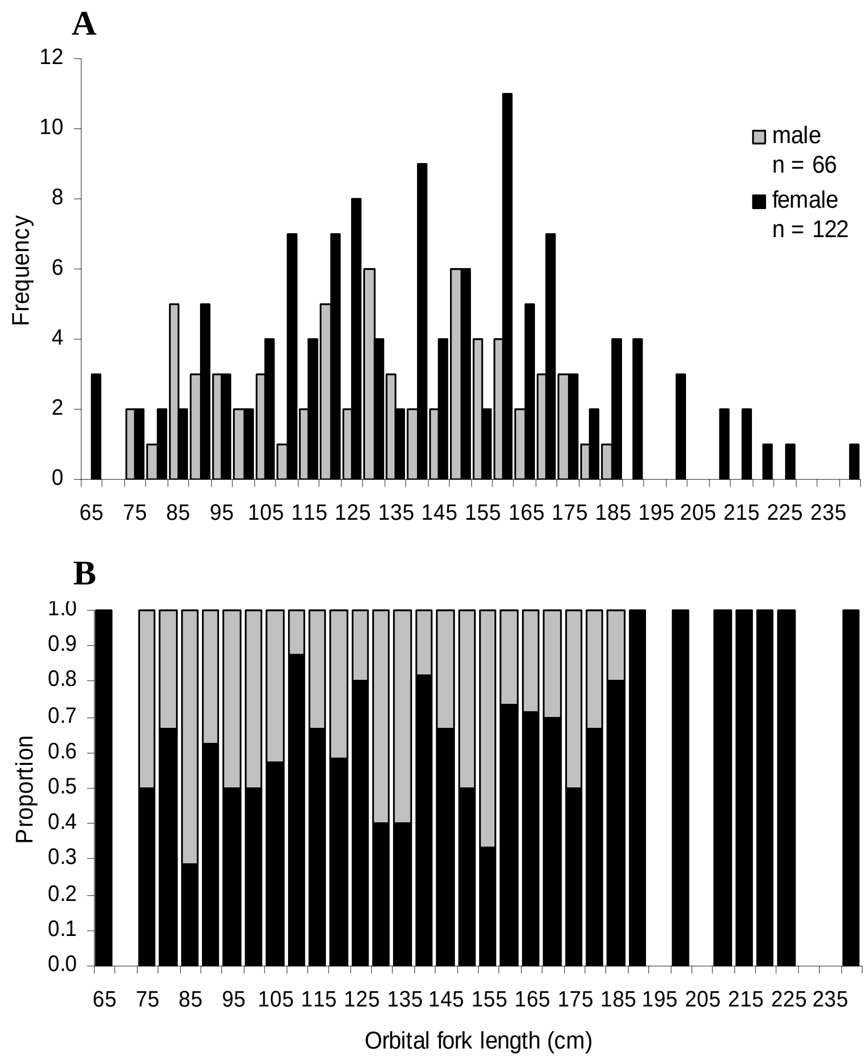


Figure 3: The size-frequency distribution (A) and proportions (B) of male and female swordfish samples collected from the western Australian longline fishery from 1995-2003.

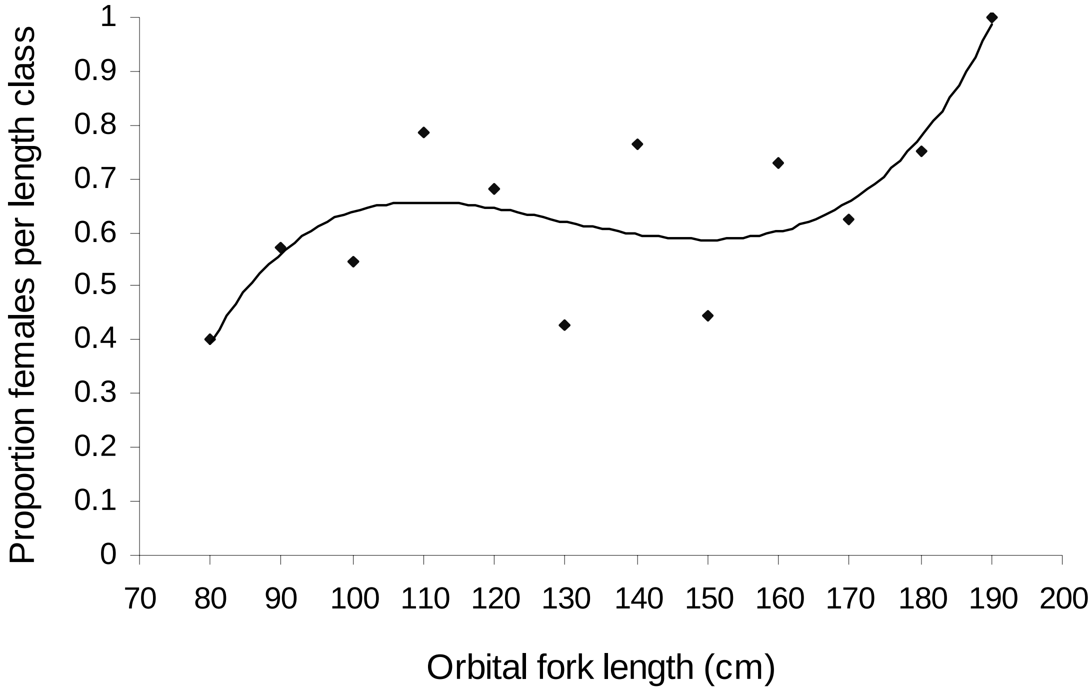


Figure 4: Proportion of females to total number of broadbill swordfish sized 80-190 cm orbital fork length, by 10cm OFL length class (n= 170).

Marginal increment and edge type analysis

The low sample numbers for this study limited the outcomes of any age validation we attempted. Nevertheless, we followed the techniques outlined in Chapter 6.1 and found, although highly variable, lower values of MIR in the months between May and August than at other times of the year. This result suggested an annual cycle of ring deposition indicating that new annuli formed from late autumn to early spring (Fig. 5). In both female (Fig. 5A) and male (Fig. 5B) samples respectively, the MIR rose in June and dropped in July and August. For female samples and both sexes combined (Fig. 5C), the monthly means of MIR in June were significantly higher than in July (two-tailed *t*-tests $P<0.05$). The mean MIR in June was also significantly higher than in May for both sexes combined, and in April for male samples (*t*-tests $P<0.05$).

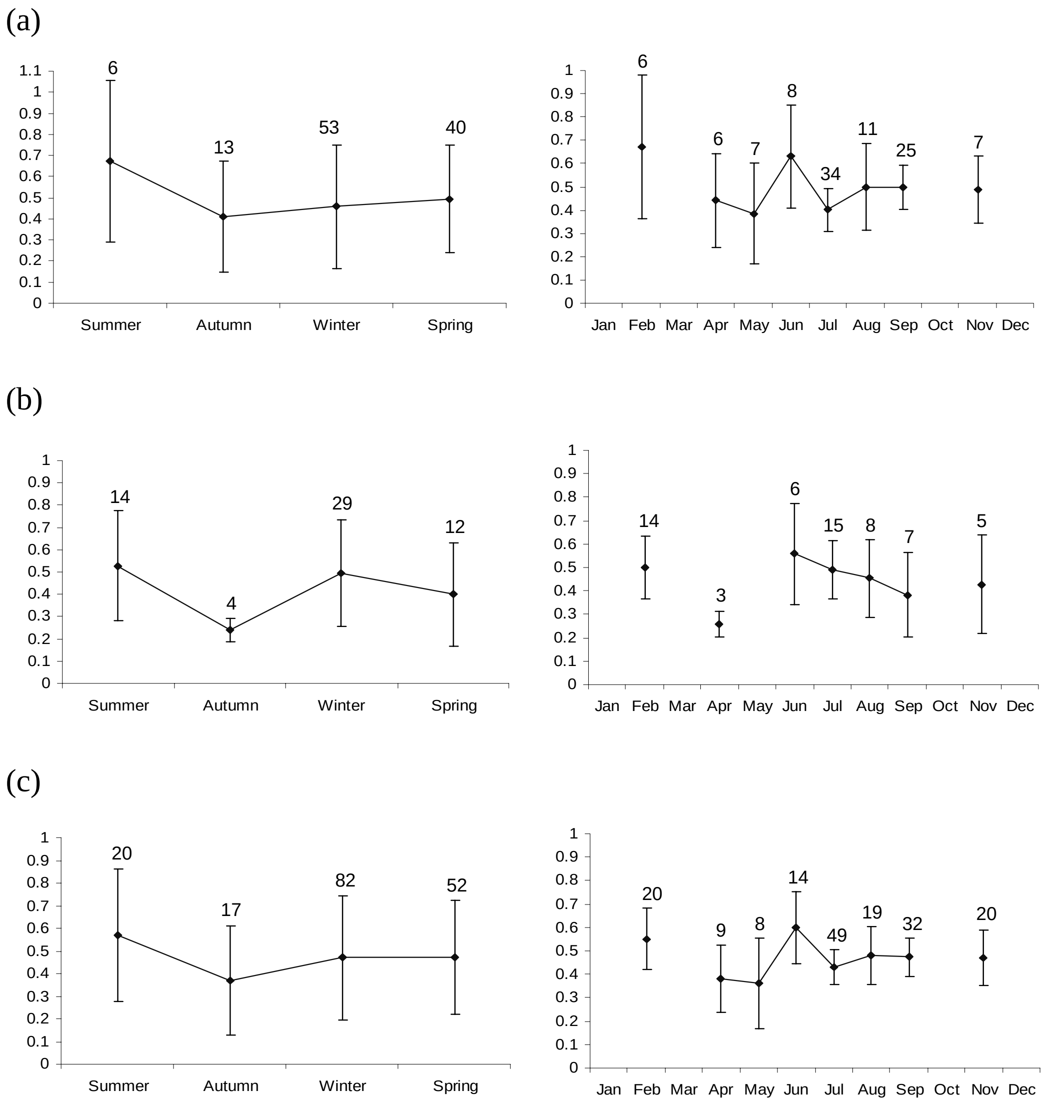


Figure 5: Monthly and seasonal means of marginal increment ratios of female (A) and male (B) swordfish, and male and female swordfish combined (C), in the Indian Ocean for all ages combined. Vertical bars are 95% confidence intervals; numbers on the top of the vertical bars are sample sizes.

In all cases, the monthly means of MIR did not differ significantly for the period from August to May (ANOVA, $P_{♀}$=0.59, $P_{♂}$=0.50, P_{both}=0.38) or over the total months sampled (ANOVA, $P_{♀}$=0.28, $P_{♂}$=0.58, P_{both}=0.21). Seasonally, there was a consistent decline in MI widths from summer to (late) autumn and a subsequent increase in MI means over winter. Summer MIR means were always higher than mean MIRs in autumn (*t*-tests $P<0.05$).

Unlike the MI analysis, which does not apply to samples less than or equal to age one, edge type analysis (ETA) could be performed for samples of all ages. Narrow opaque edges, corresponding to the beginning of a new annulus, reached a peak in June before declining as wide opaque edges subsequently increased from June to July (Fig. 6A). Seasonally, the proportion of wide opaque bands increased steadily from winter through to summer (Fig. 6).

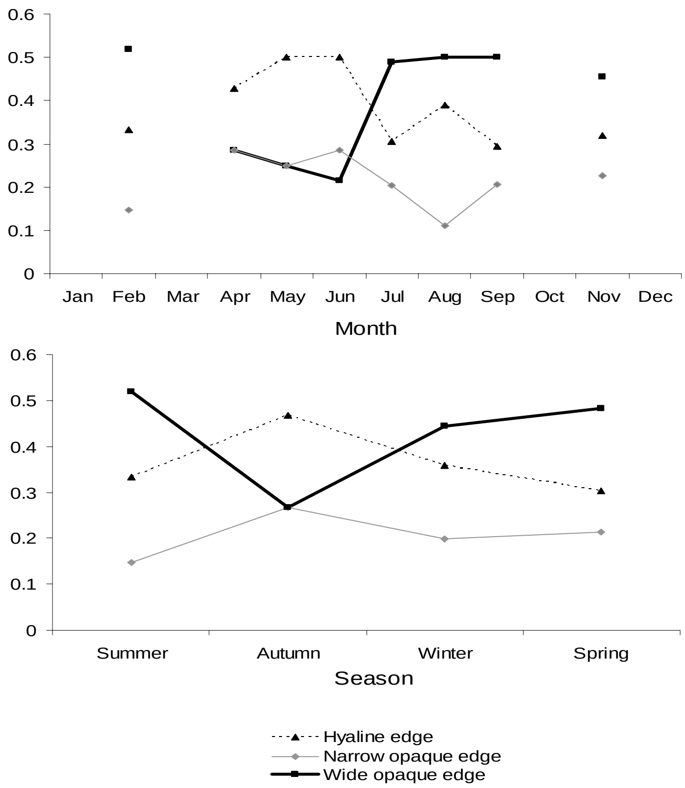


Figure 6: Proportion edge type per month (A) and season (B) for both sexes combined. Includes samples with a confidence <3.5 only. Numbers above points are total sample sizes for that month or season.

Age and growth

Up to 15 opaque bands for female and 9 bands for male swordfish were visible in the anal-fin rays examined. Sample sizes ranged between 1 and 27 for each age class when sexes were separated. Age-length keys were developed for males and females, and sexes combined using the aged fish samples (Table 4). Considerable variations in length were detected within all age classes (Table 5). Unpaired *t*-tests showed that mean orbital fork lengths for each age did not differ significantly between male and female samples aged 1 to 9 (*P*>0.05). No consistent differences (i.e. across contiguous age classes) in mean length were detected between females (aged 1 – 9 years) from the Indian and Pacific Ocean, likewise for males

Table 4: Age-length keys for all (A), female (B), and male (C) Indian Ocean swordfish samples.

A	**Age class (years)**																
OFL class(cm)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
60	2	1															3
70		3		1													4
80		5	1	4													10
90		6	4	3	1												14
100			4	5	2												11
110				6	5	2	1										14
120				6	15		1										22
130					7	2	4		1								14
140				2	3	7	2	3									17
150				1	3	4	5	2		3							18
160					1	3	7	8	3								22
170						1	3	4	5	3							16
180									3	4			1				8
190								1			1		1	1			4
200										1		2					3
210										3		1					4
220														1		1	2
230																	0
240														1			1
Total	2	15	9	28	37	19	23	18	12	14	1	3	2	3	0	1	187

B	**Age class (years)**																
OFL class(cm)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
60	2	1															3
70		1		1													2
80		2		2													4
90		4	1	2	1												8
100			2	4													6
110				5	4	2											11
120				3	11		1										15
130					5		1										6
140				2	3	5	2	1									13
150				1	2	1	2	1		1							8
160					1	2	6	5	2								16
170						1	1	2	3	3							10
180									3	2			1				6
190								1			1		1	1			4
200										1		2					3
210										3		1					4
220														1		1	2
230																	0
240														1			1
Total	2	8	3	20	27	11	13	10	8	10	1	3	2	3	0	1	122

C	**Age class (years)**									
OFL class (cm)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
70	2									2
80	3	1	2							6
90	2	3	1							6
100		2	1	2						5
110			1	1		1				3
120			3	4						7
130				2	2	3		1		8
140					2		2			4
150				1	3	3	1		2	10
160					1	1	3	1		6
170						2	2	2		6
180									2	2
Total	7	6	8	10	8	10	8	4	4	65

Parameters of the von Bertalanffy were computed for male and female Indian Ocean swordfish (Table 6) and fitted to the OFL data in Fig. 7. A decline in growth rate of males compared to females after age 5 was noted; however results of the ARSS did not reveal any significant growth differences between the sexes (Table 7). A comparison of Indian Ocean to Pacific Ocean samples revealed a highly significant difference between female samples ($P<0.0001$) but not for males. This difference was still apparent upon comparing ages 1 – 14 years

Table 5: Mean orbital fork length (cm) at age for swordfish from Indian Ocean and Pacific Ocean samples (.). Numbers in parentheses are ±95% confidence intervals, (-) denotes a sample size of 1. Dotted line delineates the age classes tested for differences in means between and within oceans.

Age class (years)	Indian Ocean			Pacific Ocean		
	Total	Female	Male	Total	Female	Male
0	68.0 (0)	68.0 (0)		74.6 (4.6)	75.4 (6.4)	73.0 (5.6)
1	85.1 (4.4)	84.5* (6.6)	85.9 (6.3)	92.9 (1.9)	93.9* (2.5)	91.4 (2.9)
2	99.4 (7.2)	102.0 (7.4)	98.2 (6.0)	109.2 (1.7)	109.5 (2.1)	108.4 (2.8)
3	110.4 (4.4)	111.6* (9.0)	107.5* (11.9)	123.4 (2.5)	124.4* (3.1)	121.5* (4.2)
4	127.0 (4.4)	128.7* (5.1)	122.3* (8.3)	135.4 (2.4)	136.3* (2.9)	133.1* (4.6)
5	145.4 (7.5)	144.1 (11.5)	147.3 (8.7)	148.7 (2.3)	150.3 (3.0)	145.7 (3.2)
6	151.8 (6.5)	153.8 (7.3)	149.2 (11.9)	159.9 (2.5)	160.3 (2.7)	158.1 (6.0)
7	162.8 (5.3)	164.8 (7.2)	160.4 (8.2)	170.5 (2.8	172.0 (3.5)	166.5 (4.4)
8	171.9 (7.9)	176.8 (6.7)	162.3* (17.4)	175.2 (3.1)	175.0 (4.2)	175.6* (3.9)
9	183.5 (11.0)	188.8 (12.8)	170.3 (17.2)	186.0 (3.7)	191.7# (4.4)	176.0# (4.6)
10	190.0 (-)	190.0 (-)		191.7 (4.4)	196.0# (5.3)	180.6# (5.3)
11	206.7 (7.3)	206.7 (7.3)		206.8 (3.8)	208.6# (3.6)	189.8# (7.8)
12	189.5 (2.9)	189.5 (2.9)		211.2 (8.1)	214.5# (9.2)	196.6# (9.4)
13	221.3 (28.3)	221.3 (28.3)		217.3 (8.8)	219.4 (8.6)	195.0 (-)
14				224.9 (9.9)	224.9 (9.9)	
15	220.0 (-)	220.0 (-)		223.0 (11.5)	224.2 (12.4)	210.0 (-)
16				235.2 (25.5)	246.8 (15.2)	189.0 (-)
17						
18						
19				227.0 (-)	227.0 (-)	
Sample size	187	122	65	1413	1000	413

* Significant difference (P<0.05) between inter-ocean samples of the same sex

Significant difference (P<0.05) between sexes intra-ocean

Table 6: Least square estimates for the standard von Bertalanffy growth models using orbital fork length (OFL) (A) and lower jaw fork length (LJFL) (B) for swordfish in the waters around western and eastern Australia. Numbers in parentheses are 95% confidence limits.

Parameter	**Indian Ocean**		**Pacific Ocean**	
A	**Female**	**Male**	**Female**	**Male**
L_∞	296.51	236.90	294.25	222.15
	(52.61)	(57.15)	(19.98)	(23.01)
k	0.0815	0.1096	0.0811	0.1347
	(0.0145)	(0.0264)	(0.0055)	(0.0140)
t_0	-3.0148	-3.0118	-3.7472	-2.9711
	(0.5350)	(0.7266)	(0.2545)	(0.3078)
B				
L_∞	323.40	260.47	321.01	244.89
	(57.39)	(46.22)	(21.80)	(25.37)
k	0.08148	0.1096	0.0811	0.1347
	(0.0145)	(0.0194)	(0.0055)	(0.0140)
t_0	-3.4130	-3.3808	-4.1501	3.2907
	(0.6056)	(0.5999)	(0.2818)	(0.3409)

Table 7: Results of the comparisons between the von Bertalanffy growth models for male and female swordfish and between eastern and western Australian waters using analysis of residual sum of squares (ARSS)

.Group	Comparison between		Parameter		
			F	*d.f.*	*P*
Indian Ocean	Females	Males	1.564	3, 181	0.199
Pacific Ocean	Females	Males	16.556	3, 1185	<0.001
Males	Indian Ocean	Pacific Ocean	0.198	3, 418	0.897
Females	Indian Ocean	Pacific Ocean	7.165	3, 949	<0.001
Females*	Indian Ocean	Pacific Ocean	6.900	3, 916	<0.001

* ages 1- 14 years old

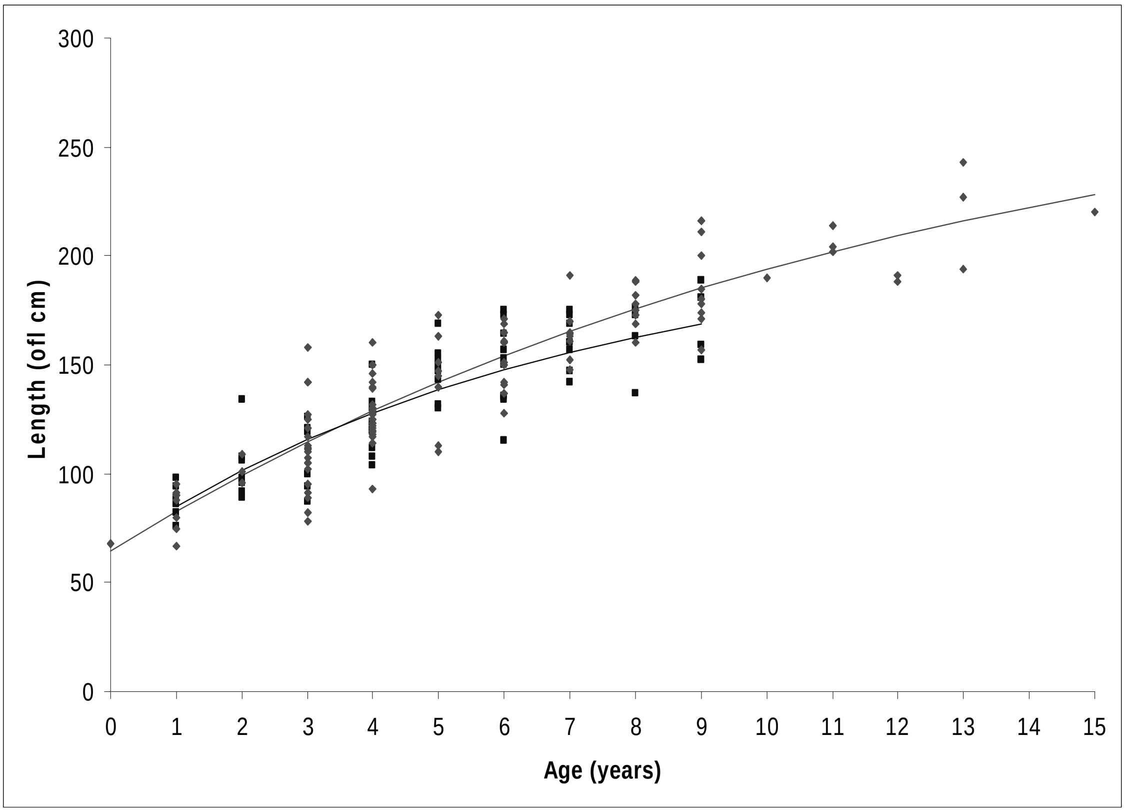


Figure 7**: Standard von Bertalanffy growth curves for female and male swordfish in the eastern Indian Ocean**

Age structure of the western Australian swordfish catch

The combined age-at-length key was applied to length frequency data to estimate the age distribution of the annual catch of swordfish for the Southern and Western Billfish Fishery for 1999 to 2002 (Fig. 8). Fish aged between three and seven years generally dominated the catch. Although age distributions varied between years, no trend was evident over the period examined. The proportion of fish age five or younger ranged between 52.2% and 60.0% except for the catch in 2000, in which 38.7% were age five or less. Only 5.3% to 9.1% of the landings were age ten or greater for the years 1999 and 2001-2002. However, of the annual catch for 2000, 18.6% were age 10 or greater. For all years, fish aged 5 or less were ~60% female, while fish aged ten or greater were ~97% female.

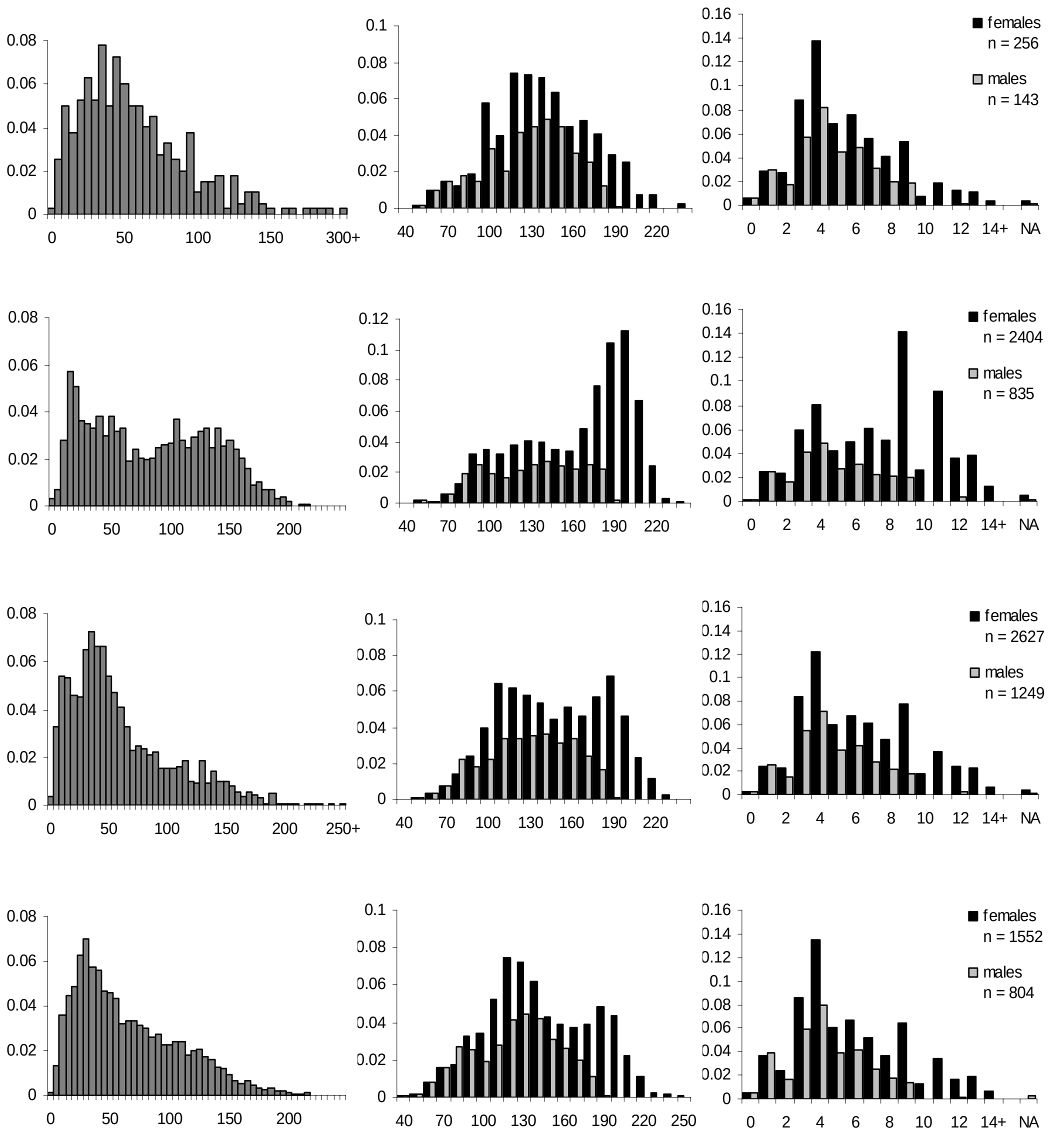


Figure 8: Weight (A), length (B) and age (C) distributions of male and female swordfish caught in the Southern and Western Tuna and Billfish Fishery for the years 1999-2002. NA = age not assigned as key did not cover the full range of lengths.

6.2.5. Discussion

Annual increment formation

Limited sample numbers hindered full resolution of the pattern of marginal increment formation in fin rays sampled from western Australian swordfish. However, when the samples were pooled in terms of sexes and/or season (Fig. 6C), the results indicated annual band formation between late autumn and early spring. Results obtained from the edge type analysis were also consistent with that from marginal increment analysis and were more successful in showing the seasonality of band deposition.

The lack of definition of timing of ring formation appears to be the result of a lack of sufficient samples on a monthly basis to obtain robust estimates, but overlaps the timing of ring formation for swordfish from eastern Australian waters (Chapter 6.1), and also overlaps that determined by Clear et al (2000). The later study showed, also from limited number of samples, the beginnings of ring formation around September to October.

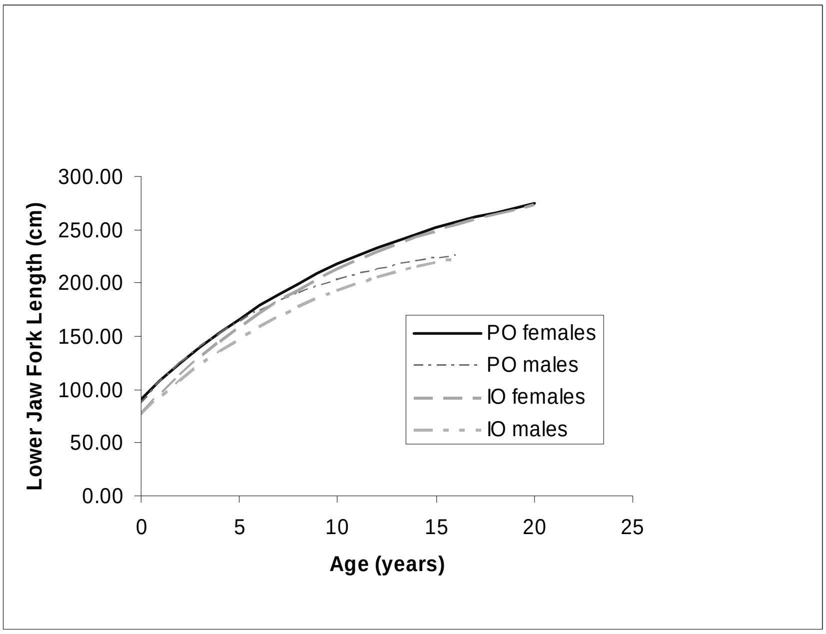
Age and growth

This report presents the first preliminary estimates of the age and growth of swordfish from Western Australian waters. Most age-determination studies have been undertaken for swordfish from the Atlantic (e.g. Berkeley and Houde 1983; Radtke and Hurley, 1983; Wilson and Dean, 1983; Ehrhardt 1992; Ehrhardt et al, 1996) and Pacific Oceans (Yabe *et al*, 1959; Castro-Longoria and Sosa-Nishizaki, 1998; Uchiyama *et al* 1998, Sun *et al*, 2002). To our knowledge there has been only one such study from the western Indian Ocean (Vanpouille *et al* 2001). As has been reported for swordfish elsewhere, females were typically larger, and lived for longer than males off Western Australia. Female swordfish in the Indian Ocean appear to grow faster than males after the age of five.

A comparison of the standard VB growth curves estimated by different authors for swordfish from the Pacific and Indian Oceans is shown in Fig. 9. Our parameter estimates are closest to those obtained by Young *et al* (Chapter 6.1) for samples from the east coast of Australia (western Pacific Ocean), and most dissimilar to the estimates of Vanpouille *et al* (2001) for swordfish from the western Indian Ocean. Asymptotic lengths were similar between eastern and western Australia, however larger t_0 values for both male and females from western Australian samples may indicate that these swordfish grow faster in the first several years of their lives. Such a result may also be due to a lack of smaller size classes available in the western Australian data.

The difference in growth between fish from the western Indian Ocean and those examined here is difficult to interpret. There is some evidence to suggest that Indian Ocean stocks of swordfish may be linked historically to Atlantic Ocean swordfish by the Aghulus current that sweeps around southern Africa (Penny and Griffiths 1998, Ward *et al* 2001). However, neither the eastern or western Australian swordfish could be genetically differentiated from swordfish from the western Indian Ocean (Ward *et al* 2001). The difference may simply reflect longer term fishing in the western Indian Ocean resulting in depletion of larger fish from the catch.

(a)



(b)

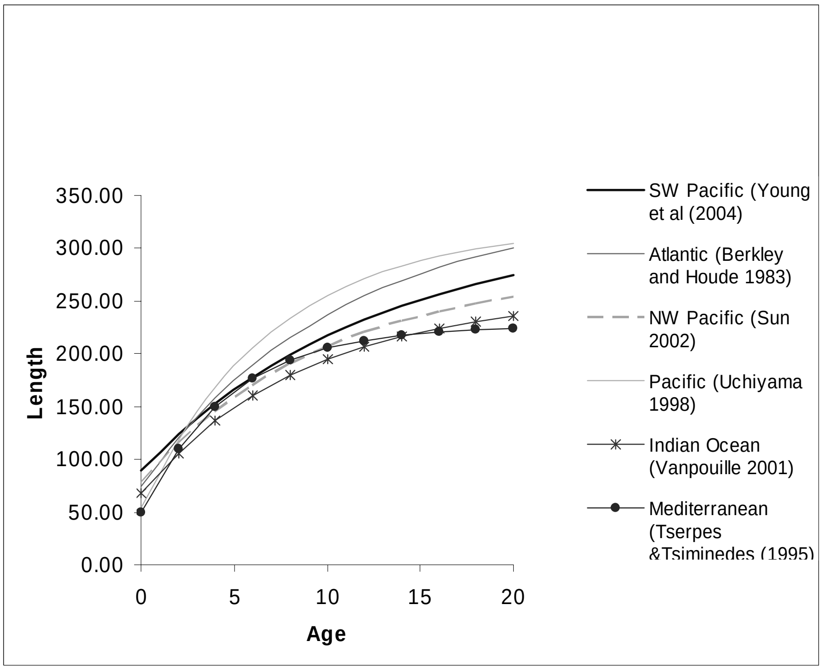


Figure 9: Comparison of standard Von Bertalanffy growth curves of (a) swordfish from eastern and western Australia and (b) female swordfish from the Pacific, Indian and Atlantic Oceans and the Mediterranean Sea

Similarities between the eastern and western Australian growth curves might reflect in part the use of highly consistent techniques and similar interpretation of ray sections. Ward and Elscot (2000) suggest that differences in aging techniques can obscure the differences in growth between regions. In any case, it appears that both male and female swordfish from Australian waters reach greater lengths than swordfish from waters around Taiwan (Sun *et* *al* 2002) or la Réunion Is. (Vanpouille *et al* 2001) and may be a reflection of the longer fishing histories of both these fisheries.

Statistical comparisons between the VB growth models of swordfish from the present study and those from eastern Australia sampled by Young *et al* (Chapter 6.1) found that there was a highly significant difference between the females, but not the males. However, if the difference found between females were in fact real, consistent differences in contiguous age classes should be apparent for the mean lengths at age between both samples. As no consistent differences were noted, it can be assumed that the differences found were an artifact created by fitting the VB curves.

High variability about the tails of the size distribution due to small sample sizes made fitting the VB growth curve difficult. Although the standard VB curve tended to overestimate values for individuals less than one year (as in Ehrhardt 1992 and Ehrhardt *et al* 1996), Tserpes and Tsimenides (1995) "recommend the use of the standard VB growth curve because the generalized model overestimates the asymptotic length, an essential parameter for population dynamics models". Upon comparing the standard VB growth function to the generalized growth function of Chapman (1961) using the same data, Tserpes and Tsimenides (1995) found that both models described swordfish growth equally well over the age 1-8. The use of any single model, however, is unlikely to precisely represent growth over the entire life span of the species (King 1995). For this reason, age-at-length keys are useful for determining the age structure of a population as the variances of ages per length class can be taken into account.

Catch-at-age

The application of age-at-length keys to length data provides the most precise means of identifying the age structure of a sampled fishery. The critical assumption of the method used to determine the age distributions of the catch is that the initial 187 samples used in the age determinations were adequately sampled, i.e. are representative of the real population and are thus applicable to the current population. Also, that the sex-ratio algorithm provides a valid separation of sexes. The polynomial equation resolved for separating the sexes in the present study is similar to that obtained by Young *et al* (2003) and Poisson *et al* (2001) for samples from eastern Australia (western Pacific Ocean) and from the western Indian Ocean respectively.

It is debatable whether the use of the combined-sex age-at-length key to convert catch-at-length data to age is sufficient for an initial assessment. Nevertheless this study provides

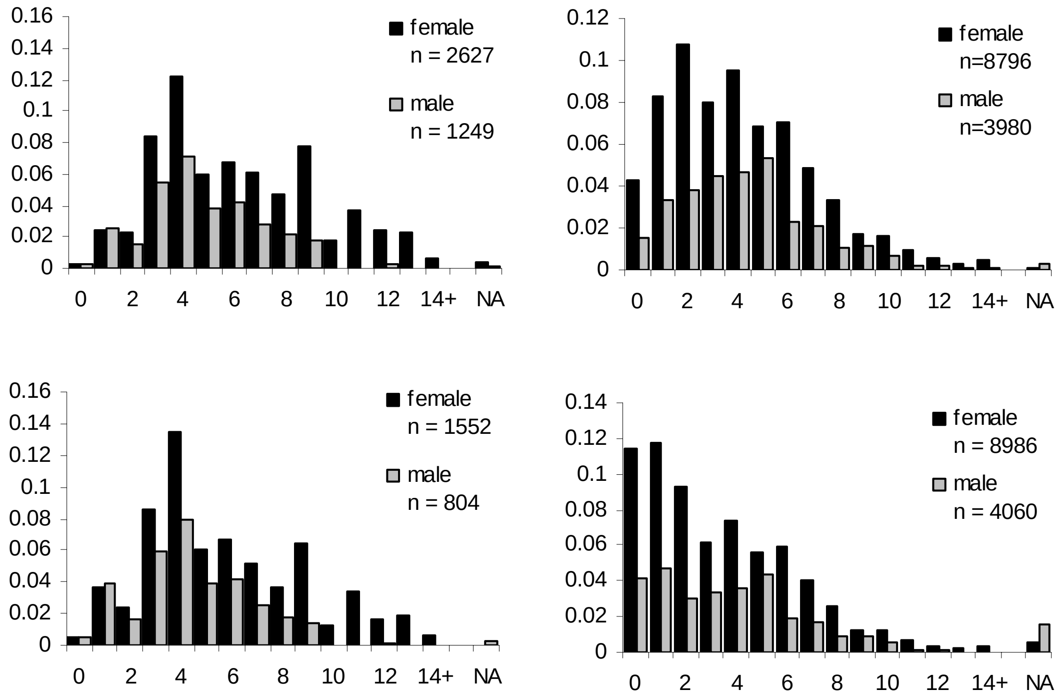


Figure 10: Comparison of 2001 (A) and 2002 (B) age distributions of swordfish catches within the Western and Eastern Australian Fishing Zones (AFZ). NA = age not assigned as key did not cover the full range of lengths. Eastern AFZ data from Young *et al.* (Chapter 6.1).

preliminary evidence that the age-distribution of swordfish landings in the SWTBF have remained relatively constant since the expansion of the domestic longline fleet five years ago. No trend toward younger age classes was evident, suggesting limited impact from fishing. However, dramatic differences can be noted upon comparing the age distributions of annual SWTBF and ETBF catches for the years 1999 – 2003 (Fig. 10).

The catch at age of swordfish from eastern Australian landings has declined significantly over the short period of the fishery. If the decline off eastern Australia is fishery-related, it demonstrates that depletion of stocks can occur over a short period of intensive harvesting.

Links between eastern and western Australian swordfish populations

Recent studies on the stock heterogeneity of swordfish populations suggested that swordfish from the western Pacific and eastern Indian Ocean formed part of the same gene pool (Reeb *et al* 2000, Ward *et al* 2001). However, both studies lacked sufficient samples from the Indian Ocean and as such were only weakly supported statistically. These studies concluded that if there were distinct stocks then the degree of separation between them was small, with observed differences in growth rates more likely to be environmental than genetic.

If the populations are genetically connected, movement between them may occur in one of two ways: The first is that there could be movement of adult swordfish around Tasmania and southern Australia (Ward *et al* 2001). Longline catch data show that swordfish have a relatively continuous distribution around southern Australia, although small catches off South Australia suggests that this region is not a major migration route for swordfish and therefore interchange between the eastern and south-western AFZ is probably slight (Ward *et al* 2001, Ward and Elscot 2000, Campbell and Taylor 2000). Transport of swordfish larvae and juveniles from the western tropical Pacific to the north-east Indian Ocean by the Indonesian through-flow is another possibility (Gordon and Fine 1996, Ward *et al* 2001). However, interchange of adults across northern Australia is less likely due to the warm and shallow waters within the region (Campbell and Taylor 2000). Neither of these scenarios suggests there is a high degree of connection between the two areas.

Whether or not the eastern and western populations are from different stocks is debatable. However, a comparison of the VB curves from the two regions show curves that are more similar than would be expected for two genetically distinct stocks. A combination of tag-recapture and genetics studies focused within and around the AFZ would provide more precise information on the movement and heritability of local swordfish populations.

Conclusions

Although swordfish have been taken from Western Australian waters by Japanese longliners since the mid 1980's, prolific spatial and effort expansion of the swordfish industry has occurred rapidly over a brief period of six years. Although our sample size from the western Australian fishery was relatively small and therefore to be viewed with caution, we could find no evidence of a shift in the age structure of the catch over this time. We have provided the first growth curves, age-at-length keys and estimated catch-at-age for swordfish in western Australian waters which can be used for future age-based assessment models.

Our study showed that growth rates of Western Australian swordfish were not different from swordfish in eastern Australian waters. However, more research is needed on the spawning stock biomass of swordfish in the region and the geographical extent of the stock (Reeb *et al* 2000, Patterson *et al* 2002). We are confident that the accuracy of our age determinations has allowed for a useful preliminary assessment of swordfish age and growth in the western AFZ. Continued sampling will allow for increased confidence and validation of these estimates.

Limitations of the study

The data for this study are widely separated over time (a period of 8 years) and space and as such have not been exposed to similar environmental conditions and exploitation rates

(Ehrhardt, 1992) and so could include individuals that experienced different growing conditions. Furthermore, as less than 200 fish examined, we suggest our results should be viewed with caution. Limited sample numbers also prohibited statistical verification of an annual cycle of band deposition. However, this study does provide a baseline from which other studies can be compared.

6.2.6 Acknowledgements

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6.3 Daily ageing of juvenile broadbill swordfish, Xiphias gladius Linnaeus 1758, from eastern Australia using otoliths

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6.3.1 Abstract

The sagittal otoliths of 22 juvenile swordfish collected from the eastern Australian longline fishery between August 1998 and December 2001 were examined for presumed daily increments. Otoliths were observed in transverse plane and viewed under light microscopy. Two otoliths were also examined with scanning electron microscopy. Significant linear relationships were found between fish length, otolith size and increment counts indicating that the increments could be used to age juvenile swordfish. Estimated ages ranged from 90 to 705 days in fish ranging in size from 59 cm to 151 cm OFL. A comparison between SEM and light microscope observations indicated that light microscope readings of increments under reported those from SEM in fish greater than 90 cm OFL. Back-calculated spawning dates indicated year-round spawning for the fish examined, but were concentrated between November and February, which is the main spawning period for swordfish in these waters.

6.3.2 Introduction

Broadbill swordfish, *Xiphias gladius*, are one of four pelagic species targeted by the Eastern Tuna and Billfish fishery (ETBF). Annual landings of greater than 2000 tonnes have been maintained since the mid 1990s. However, recent localized depletions within the ETBF have highlighted the need for accurate biological data, including those on age and growth, to support sustainable management of the species (Campbell 2002).

Most studies of swordfish age and growth have relied on increment counts of transverse sections of the second anal fin ray. Their general usage has arisen from their ease of collection and readability over a wide range of size classes. However, the central part of the ray is often vascularised, especially in older fish, making resolution of the early growth stages difficult. An alternative method to estimate growth in young swordfish could therefore help to resolve this period of the fishes' life.

However, otoliths have not been widely used for age estimation of swordfish because of their very small size and fragility, although the development of better techniques to read the otoliths has helped to increase their usefulness, at least in juvenile swordfish (Ward and Elscot 2000). There are several general advantages to using otoliths as ageing structures. Firstly, they are not susceptible to resorption. Second, they grow isometrically as fish grow; and thirdly they undergo little alteration once formed. Microincrements have been observed in the sagittal otoliths of juvenile swordfish from the Atlantic Ocean (Wilson and Dean 1983), Mediterranean Sea (Megalofonou et al 1995) and more recently in larvae from the Atlantic Ocean (Govonni et al 2003). Although their increments have yet to be validated as daily, they are similar to the increments observed in other pelagic species for which at least indirect validation is available (e.g. Jenkins and Davis 1990).

The aims of this study were to (1) estimate the age of growth of juvenile swordfish using otoliths, (2) compare otolith- and fin ray-derived ages and (3) compare resulting back-calculated birthdates with the spawning period of swordfish in eastern Australian waters.

6.3.3 Methods

Collection of samples

Broadbill swordfish otoliths were provided for this study by the tuna and billfish hard-parts archive held at CSIRO Marine Research. The otoliths were sampled from swordfish taken by the domestic longline fishery operating off eastern Australia between ~ 25°S and 35°S, from August 1998 to December 2001 (Table 1). Otoliths were either removed at sea by observers, or in the laboratory from samples of fish heads collected by cooperating fishers. In the laboratory, otoliths were teased from surrounding tissue, cleaned and dried (Haake et al. 1982, Wilson and Dean 1983).

Sample preparation and analysis

Twenty one sagittae otoliths were selected from fish < 120cm Orbital Fork Length (OFL), the approximate age of a 1 year old (Berkeley & Houde 1983). A sagittal otolith was also selected from one fish 151 cm (OFL) for examination. Lapilli from these fish were also examined but were found unsuitable for further analysis. Otoliths were embedded in resin and sectioned transversely as this provided the clearest view of the increments. Both sides of the otoliths were ground using 220, 600, and 1000 grit wet-dry emery paper. Sections were then polished with an automatic lapping and polishing machine using 6µm and 3µm diamond paste, to remove surface scratches. Sectioning and polishing of sagittae enhanced the light microscopy images, particularly in the area near the core (Fig. 1).

The radius of each sagittae (primordium to ventral edge) was measured to the nearest 0.1mm under a light microscope. Increments were observed in the sectioned otoliths using light microscopy (magnification*100 with oil) adapted for video viewing. For each sagittal otolith, sequential images (up to 20) from the otolith core to the margin were captured, saved and printed. These were joined together to produce a "poster" of each otolith sections (Fig. 2). Increment counts were made from the core to the distal edge from the printed sheets. For all sagittal otoliths, we found some areas along the section where increments were indistinct. Where this occurred, we measured the length of the area on the poster where the increments were indistinct and estimated the number of increments using the density of increments before and after the region. Leroy (2001) found that the density of increments was consistent along the arm of the otolith. We gave each otolith reading a confidence score by calculating the proportion of indistinct to distinct increments along the length of the otolith. A ratio <10% of indistinct to distinct bands = A (excellent), 10-20% = B (good); and >20% = C (poor) (Table 2).

Counts of increments were made twice for each sample by the same reader. Specimens were examined randomly and without reference to information on the sampled fish. An average percent error was estimated from the two counts (Beamish and Fournier 1981). The mean of the two counts was used as the final number of increments (Table 3) which we assumed to be age in days. Using this information and the capture date, we calculated the birth date of each fish (Table 4).

Table 1: Collection information and hard parts collected from swordfish sampled from the ETBF (OFL, orbital fork length; U, sex unknown, f=female; m=male)

BBL#	Date of capture	Sex	OFL (cm)	Otoliths	Fin spines	Latitude	Longitude
2	10-Aug-98	Female	116	Present	Absent	26.25	153.97
3	11-Aug-98	Female	112	Present	Absent		
15	6-Nov-98	Unknown	100	Present	Present	24.93	154.38
18	6-Nov-98	Unknown	151	Present	Absent	25.17	154.35
223	22-Feb-00	Female	104	Present	Present	28.83	160.35
242	22-Feb-00	Male	108	Present	Present	28.83	160.33
251	22-Feb-00	Female	99	Present	Present	28.97	160.55
256	18-Feb-00	Female	109	Present	Present	29.00	160.42
294	19-Feb-00	Male	119	Present	Present	28.92	160.33
507	7-Sep-00	Female	88	Present	Present	27.00	161.30
568	5-Jan-01	Female	95	Present	Present	29.30	155.67
574	6-Jan-01	Male	112	Present	Present	28.68	154.08
606	7-Jan-01	Female	73	Present	Present	27.85	154.58
608	6-Jan-01	Male	108	Present	Present	28.12	155.75
639	1-Mar-01	Male	78	Present	Present	27.83	155.38
677	8-Mar-01	Unknown	60	Present	Present	26.88	162.47
678	8-Mar-01	Unknown	59	Present	Present	26.88	162.27
842	10-Aug-01	Female	79	Present	Present	33.05	152.50
845	10-Aug-01	Male	94	Present	Present	33.05	152.50
855	4-Aug-01	Male	82	Present	Present	33.30	152.67
859	7-Aug-01	Male	80	Present	Present	33.72	152.37
1089	5-Dec-01	Male	76	Present	Present	27.25	157.2

We compared our daily age estimates with estimates obtained from electron microscopy provided by Leroy (2001). The sagittae otoliths used by Leroy (2001) were also provided by the archive of hard-parts held at CSIRO Marine Research. However, only two otolith samples were common between the studies. A further comparison was made between daily counts of sagittal otoliths and annual counts from fin rays sampled from the same fish (n=19).

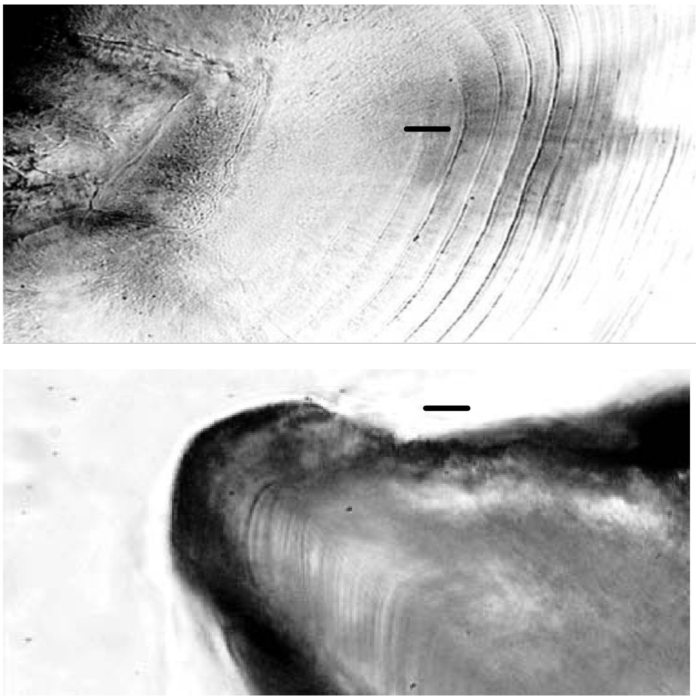

Figure 1: Core and edge region of sagittal otolith of a juvenile swordfish showing presumed daily increments. Note the decrease in increment width towards the margin (scale bar 5 µm).

Figure 2: The first author with “posters” of three swordfish sagittae from which increment counts were made

6.3.4 Results

Increment counts from sagittal otoliths

Sagittae otoliths observed under light microscope contained distinct increments along the transverse plane of the sagittae. Each increment consisted of a light and a dark zone as viewed by transmitted light, equating to the incremental and discontinuous zones referred to respectively by Wilson and Dean (1983). The primordium was clearly visible as a dark spot in the centre of the core and from which increments ~ 5 µm wide could be observed, gradually decreasing in width to <1 µm at the edge of the otolith (Fig.1). These increments were similar in appearance to the increments observed in otoliths for which daily validation has been achieved (Tanaka et al 1981). The number of increments counted ranged from 90 in a 60 cm OFL fish to 705 for a 151 cm OFL fish. The average percent error between readings was 0.86 % (Table 3).

Age estimation

A positive linear relationship was found between sagittal otolith radius and OFL (r^2=0.81) (Fig. 3). The relationship between otolith radius and number of increments was also linear (r^2=0.81) (Fig. 4) as was the relationship between fish length and number of increments (r^2=0.93) (Fig. 5). The close relationships between OFL and otolith size, and between OFL and increment counts support their use as a proxy for age in these fish. Although sample size (n=22) prohibited any statistical comparison between male and female swordfish within the size range examined, no obvious differences were found between the growth rates between sexes (Fig. 5). Back-calculated birth dates from the increment counts of the swordfish showed that although spawning ranged over the year there was a concentration of spawning in the Australian spring and summer (Table 4).

Table 2. Final increment counts and associated confidence given to sagittal otoliths of the swordfish examined

BBL#	Sex	OFL (cm)	Radii measurement (mm)	Distinct increments (A)	Indistinct increments (B)	Total increments (A + B)	Otolith's total length on the poster (cm)	Distance on otoliths poster of indistinct increments (cm)	Percentage of estimation	Count quality
2	F	116	0.34	291	74	365	132	16	12.10%	B
3	F	112	0.45	294	76	370	150	14	9.30%	A
15	U	100	0.86	280	70	350	110	12	10.90%	B
18	U	151	0.58	564	564	1128	160	29	18.10%	B
223	F	104	0.48	345	10	355	155	2	1.30%	A
242	M	108	0.68	210	160	370	130	33	25.40%	C
251	F	99	0.81	279	66	345	125	19	15.20%	B
256	F	109	0.66	355	45	400	190	9.5	5.00%	A
294	M	119	0.79	300	90	390	170	27	15.90%	B
507	F	88	0.69	272	63	335	140	24	17.10%	B
568	F	95	0.83	310	20	330	135	3	2.20%	A
574	M	112	0.76	230	130	360	130	29	22.30%	C
606	F	73	0.6	100	65	165	87	10	11.50%	B
608	M	108	0.67	280	95	375	115	20	17.40%	B
639	M	78	0.54	190	25	215	97	4	4.10%	A
677	U	60	0.64	80	10	90	105	4	3.80%	A
678	U	59	0.81	85	35	120	100	20	20.00%	C
842	F	79	0.78	105	61	166	105	22	21.00%	C
845	M	94	0.84	200	60	260	100	18	18.00%	B
855	M	82	0.81	195	25	220	90	8	8.90%	A
859	M	80	0.8	175	25	200	85	21	24.70%	C
1089	M	76	1.12	100	100	200	75	19	25.30%	C

Table 3 Calculation of Average Percentage of Error (APE) (Beamish and Fournier 1981) between increment counts.

BBL#	Count n°1 of number of increments	Count n°2 of number of increments	# Read	Mean	APE
2	362	368	2	365	0.822
3	364	376	2	370	1.622
15	346	353	2	349.5	1.001
18	704	706	2	705	0.142
223	354	356	2	355	0.282
242	370	370	2	370	0.000
251	346	345	2	345.5	0.145
256	397	403	2	400	0.750
294	387	393	2	390	0.769
507	335	335	2	335	0.000
568	333	327	2	330	0.909
574	358	362	2	360	0.556
606	162	168	2	165	1.818
608	373	376	2	374.5	0.401
639	217	213	2	215	0.930
677	88	92	2	90	2.222
678	124	117	2	120.5	2.905
842	165	167	2	166	0.602
845	261	260	2	260.5	0.192
855	224	216	2	220	1.818
859	194	196	2	195	0.513
1089	199	201	2	200	0.500

Table 4: Back-calculated birth dates of swordfish determined from increment counts using light microscopy

BBL#	Date caught	Total increments	Birth date
2	10-Aug-98	365	11-Aug-97
3	11-Aug-98	370	5-Aug-97
15	6-Nov-98	350	21-Nov-97
18	6-Nov-98	705	8-Aug-96
223	22-Feb-00	355	4-Mar-99
242	22-Feb-00	370	17-Feb-99
251	22-Feb-00	345	14-Mar-99
256	18-Feb-00	400	14-Jan-99
294	19-Feb-00	390	25-Jan-99
507	7-Sep-00	335	8-Oct-99
568	5-Jan-01	330	10-Feb-00
574	6-Jan-01	360	12-Jan-00
606	7-Jan-01	165	26-Jul-00
608	6-Jan-01	375	28-Dec-99
639	1-Mar-01	215	29-Jul-00
677	8-Mar-01	90	8-Dec-00
678	8-Mar-01	120	8-Nov-00
842	10-Aug-01	166	25-Feb-01
845	10-Aug-01	260	23-Nov-00
855	4-Aug-01	220	27-Dec-00
859	7-Aug-01	195	24-Jan-01
1089	5-Dec-01	200	19-May-01

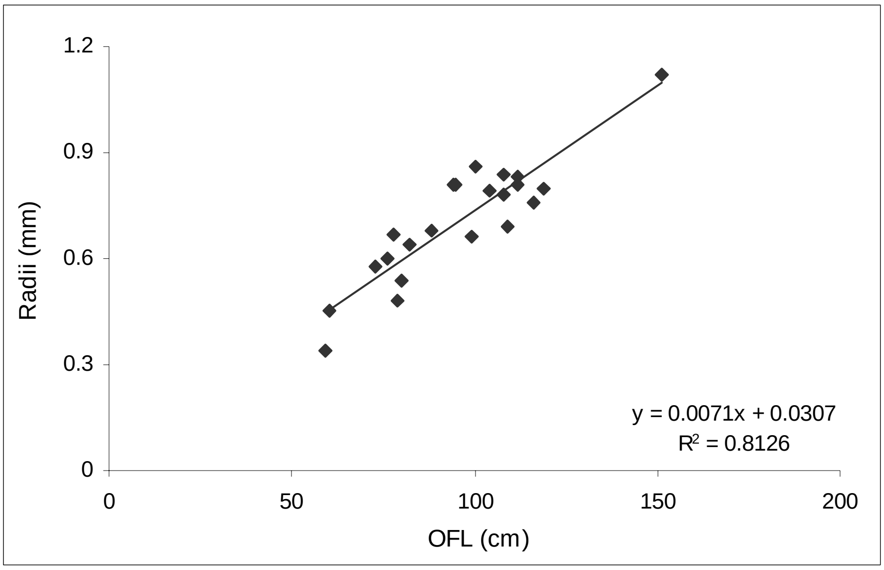

Figure 3 Relationship between orbital fork length and sagittal radius of juvenile swordfish collected from the eastern Australian longline fishery

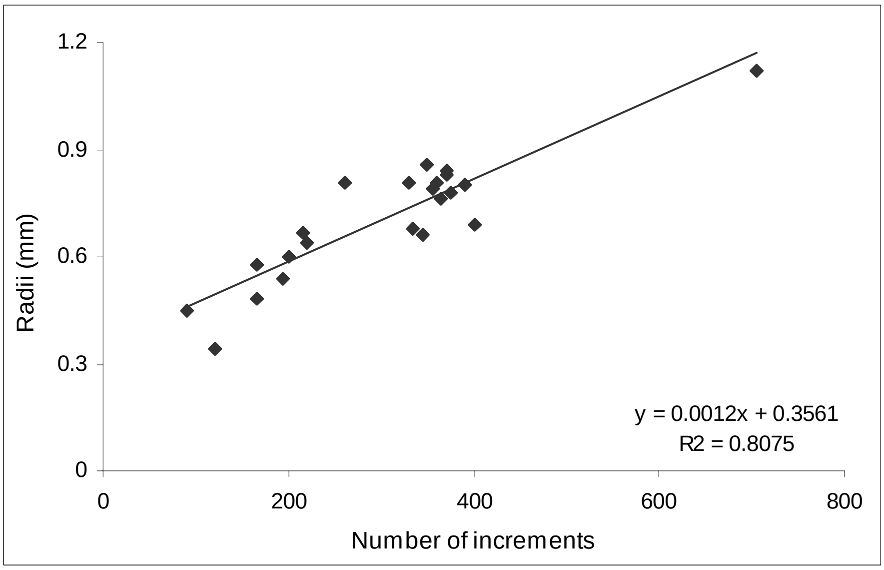

Figure 4: Relationship between otolith radius and number of increments in the sagittal radius of juvenile swordfish collected from the eastern Australian longline fishery

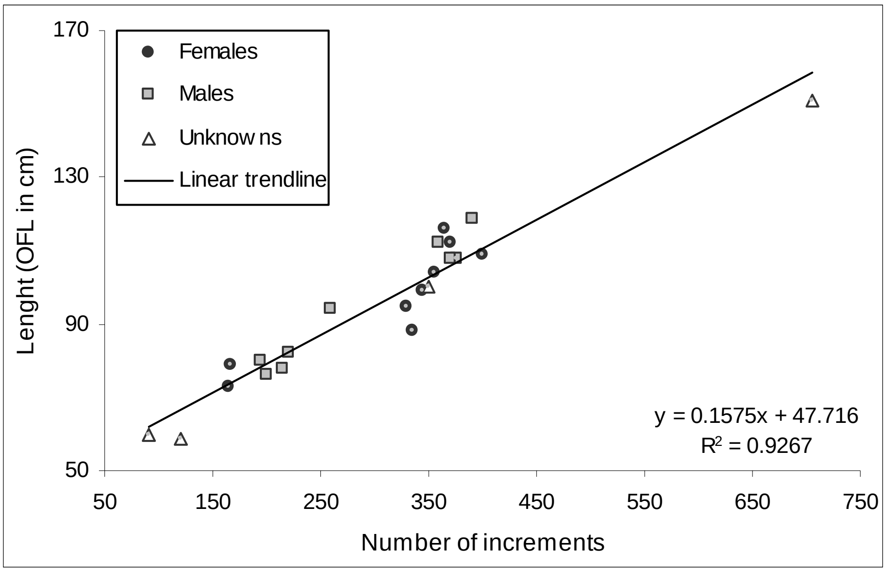

Figure 5: Relationship between fish length (OFL cm) and number of increments in the sagittal radius of juvenile swordfish determined from increment counts from transverse sections

Comparisons with SEM

Figure 6 shows a comparison of the daily age estimates from light microscopy compared with estimates by Leroy (2001) using SEM. Apart from samples 1 and 2 the otoliths counts came from fish from widely separated regions, so may reflect different growing environments rather than differences in methodology, but indicate that light microscopy failed to detect all increments in fish larger than 100 cm OFL. The two samples that were examined by both methods suggest that light microscope counts were able to resolve increments for fish to at least 90 cm OFL. The increment counts by both techniques of sample 1 (Fig.6), an 88 cm OFL swordfish, were nearly identical. The comparison for sample 2, however, appeared to be underestimated by light microscopy.

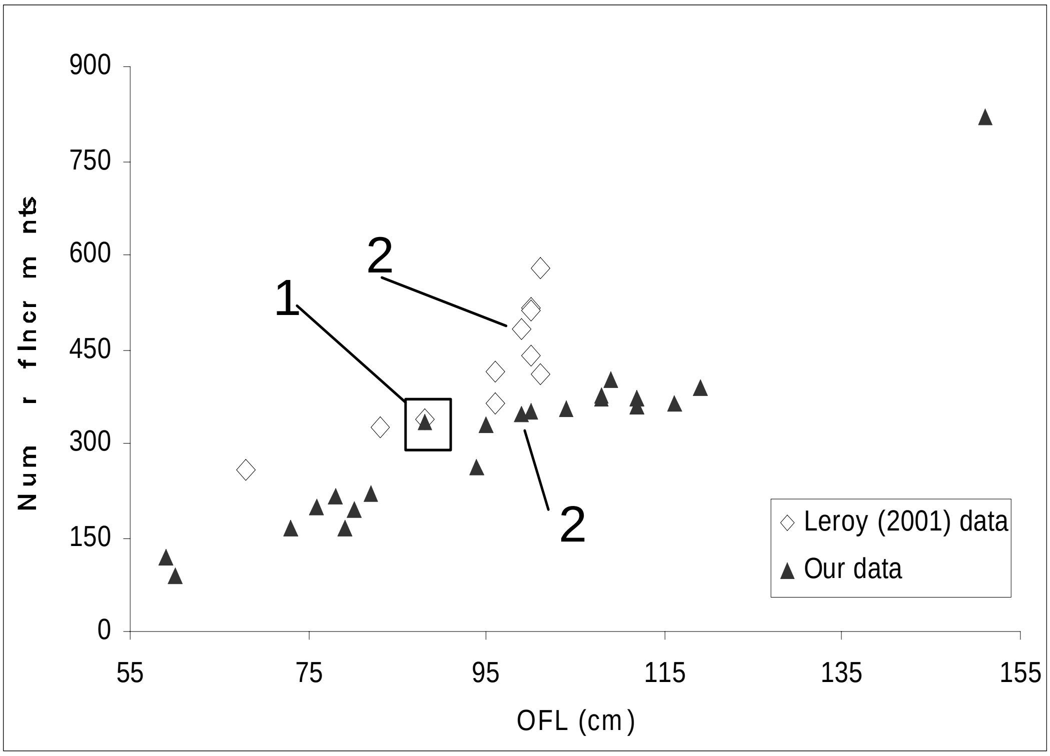

Figure 6: Number of growth increments from otoliths in relation to the length of swordfish (OFL in cm) using light microscopy (filled triangles) and SEM (open diamonds). Samples 1 and 2 were readings of the same otolith by either light microscopy or SEM.

Otolith and fin ray comparison

All swordfish from which otoliths were examined were also aged using anal fin rays. All had a minimum of one annulus. However, increment counts showed that many of these fish were less than 1 year old. The wide range of daily increment counts for these 0+ fish reflecting the extended spawning period known for swordfish in these waters.

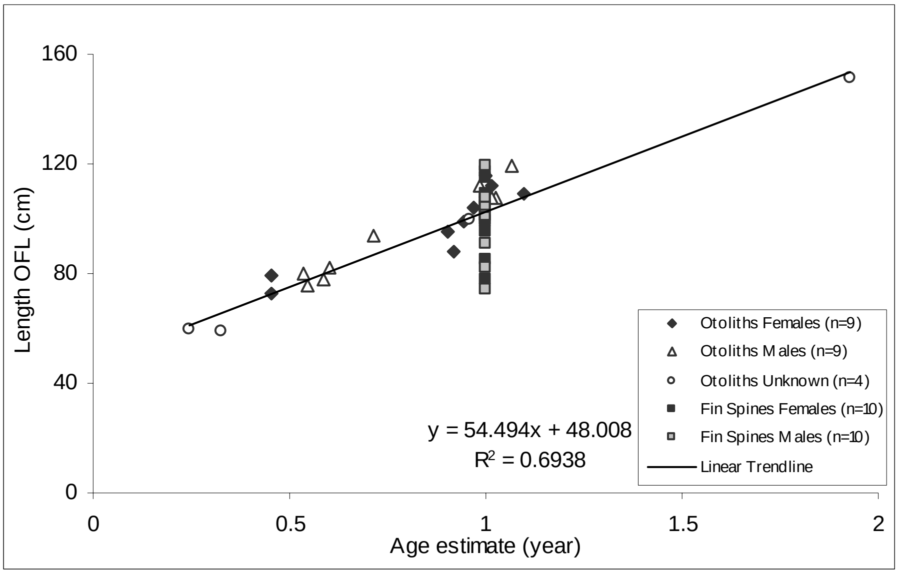

Figure 7: Comparison between daily age estimates from otoliths and annulus counts from anal fin rays for “year old” swordfish.

6.3.5 Discussion

The suitability of otoliths for ageing of swordfish

The similarity of increments in swordfish otoliths to other species where such increments have been validated as daily have been noted previously (e.g. Megalofonou et al 1995). However, the use of otoliths generally as a practical ageing tool for swordfish is limited, particularly if the aim is to determine length-at-age for a large number of fish across a wide range of ages. Counting otolith increments is time consuming and requires more preparation time than the anal fin ray method (see Chapter 6.1). Typically, most studies of swordfish otoliths, including the present study, relied on counts from relatively few individuals. Megalofonou et al (1995) examined otoliths from 21 juvenile swordfish; Govonni et al (2003) examined 37 specimens. However, with the limitations imposed by the lack of any direct validation of any presently used age estimation method, supporting methodologies such as otolith examination can add useful information to our understanding of swordfish growth, particularly for juveniles.

Light microscopy versus SEM

Previous studies reported no difference between increment readings of otoliths obtained from either light or scanning electron microscopy (Wilson and Dean 1983, Megalofonou et al 1995). Megalofonou et al (1995) found that there was no significant difference between counts made using light microscopy, SEM and video projection for swordfish within a size range of 51 to 74 cm LJFL (38.5 - 59.9 cm OFL). In the present study, however, although we matched light microscopy and SEM increment counts for an 88 cm OFL fish, we were unable to match counts for a fish 99 cm OFL in length. Although direct comparison was limited to only two specimens, the higher increment counts obtained for the fish larger than 100 cm OFL, suggests that accuracy is compromised when using light microscopy on otoliths from fish beyond this size.

Comparison of daily and annual age estimation

Although anal fin rays appear to provide the most useful estimate of swordfish age, overall rapid growth within the first year and an extended spawning period (Young et al 2003), means that the timing of first annulus formation is difficult to detect. Fish aged with fin rays and given an age of 1 yr may be less than 1 yr old or almost, but not quite 2 yr old. If, for example, annuli are deposited in the ray around September/October (Chapter 6.1), then the first annulus is deposited between 7-10 months depending on when spawning occurred. Also, because of the initial rapid growth it is extremely difficult to fit a realistic growth curve using the Von Bertalanffy model which includes young fish. That we computed a length at t_o (time of birth) of ~80cm for the species, which is biologically impossible, underlines this fact (Chapter 6.1). A number of attempts have been made to use alternatives or variations to the standard VB curve but most studies have returned to, or at least included, the standard form for comparison (reviewed also in Chapter 1). From this perspective therefore, providing information on the early period of the fishes' life history supports the inclusion of otoliths in support of wider studies of swordfish age and growth.

Indirect evidence of increment formation

As we have no direct way to validate the timing of increment formation, other lines of evidence are needed to at least examine whether the counts have biological meaning. Megalofonou et al (1995) found that back-calculated birth dates of 21 juvenile swordfish from the Mediterranean Sea coincided with timing of gonad maturation in mature females and the presence of swordfish larvae in the plankton. In a study of the reproduction of swordfish from the eastern Australian region, Young et al (2003) showed that the majority of swordfish are spawned between September and March. Larval collections of swordfish off eastern Australia are very scarce. However, Bruce (CSIRO unpublished) reported two larval specimens collected in January and May 1983 from the same region. Also, records from the Australian Museum note 2 larvae collected from the Coral Sea in November 1983 and a further 4 larvae collected in January 1990. Seventy percent of the back-calculated birth dates from the fish examined here were between November and March.

Growth rates of juvenile swordfish

Recent studies of larval and juvenile swordfish have revealed a complex growth trajectory in swordfish larvae that extends at least till 75 cm LJFL (~60 cm OFL) (Megalofonou et al 1995, Govonni et al 2003). Larval swordfish grow to 120 mm in a two step trajectory, the second significantly faster than the first, reaching 11 mm per day, one of the fastest recorded for pelagic fishes (Govonni et al 2003). At 60 cm LJFL growth is slower at ~6 mm per day (Megalofonou et al 1995). Our estimate of growth rate for fish up to one year old of ~3 mm per day suggests that growth slows relative to the preceding stages.

However, growth rates for the overall period are relatively fast and comparable to other pelagic tuna and billfishes (e.g. Brother et al 1983, Prince et al 1991).

6.3.6 Acknowledgements

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7. Conclusions

Our primary objective of establishing whether the growth rings observed in transverse sections of swordfish fin rays were laid down over a yearly cycle was met for male and female swordfish when age classes were combined. There was a clear pattern of increment formation starting in late winter, presumably at the time of slower somatic growth (Objective 3). However, when year classes were examined separately, not all years showed significant differences in the marginal increment between different times of the year. This may partly be due to uneven sample sizes from the different seasons/year class combinations. Although the fishery operates year round swordfish were not always targeted and were sometimes actively avoided. Thus sample numbers were low for some year classes, particularly from the winter months when marginal increments first formed (Objectives 1 and 2). It should be noted here that the introduction of observers in 2003 to the fishery will help in the collection of samples for future studies of this kind.

Other methods used to indirectly validate swordfish age determinations included an examination of presumed daily increments of swordfish otoliths, an inter-laboratory comparison of our reading techniques and a range of statistical analyses. The combination of these activities indicated a seasonal cycle of opaque band deposition supporting the continuation of the study.

We found that female swordfish grew significantly faster, to an older age and to a larger size than male swordfish, although growth rates were indistinguishable for fish less than 9 years old. The oldest female we examined was 19 years and the oldest male was 15 years old. The resulting growth curve for the eastern fishery fitted within an albeit wide range of growth curves provided by previous studies from the northern hemisphere. Notably different were those from the Mediterranean Sea and from the Indian Ocean. As both these fisheries have a long history of fishing the difference may be the result of fishing down of the older age classes in those fisheries.

Using information gathered on the size at maturity of swordfish from the same region (Young et al 2003), we found that female swordfish reached age at 50% maturity at 10 years of age. Males reached 50% maturity at ~2 years old. The age of sexual maturity determined for females was significantly older than that determined for swordfish elsewhere and may help to explain why swordfish are particularly vulnerable to overfishing.

We provided a sex-separated estimate of mean size-at-age (Objective 4). We used the resulting lengths-at-age calculations to estimate the age distribution of the swordfish catch for both the eastern and western Australian swordfish catch. We found that for the ETBF there was a general decrease in the age of the swordfish caught by the fishery over the period of the study. Whether this was due to overfishing or successful recruitment has yet to be determined, although similarities with other heavily fished populations of swordfish indicate that the stock may be overfished. In contrast, a similar comparison of the SWTBF, where fishing has been less intense, found no difference in the catch at age over the short life of that fishery.

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8. Benefits and Adoption

This study provides the first assessment of age and growth of swordfish in Australian waters. It has revealed a number of features of the animal's biology and proposed areas for future study that will support sustainable management of the fishery.

The benefits of studies such as this one usually take some time to flow through to management. However, this study was developed in conjunction with an operational model for the fishery (Campbell and Dowling 2003). This model presents scenarios based on the biology of the species and different strategies and intensities of fishing. As such, the information gained will be directly integrated into our understanding of the fishery. The developing operational model relied on data from northern hemisphere studies. However, this study has shown that different population parameters exist for the species in Australian waters.

8.1. Reference

Campbell, R. A. and Dowling, N. (2003) Development of an operational model and evaluation of harvest strategies for the Eastern Tuna and Billfish fishery. Project 1999/107, Fisheries Research and Development Corporation, Canberra

9. Planned outcomes

The planned outcomes of the project were to improve the biological parameters required for age-based stock assessments of broadbill swordfish in the Australian region. The results of this project have contributed to the body of knowledge of the biology, life-history traits and population dynamics of swordfish. The parameters we determined for the age and growth of swordfish in the region will support age-based stock assessments for the species in Australian waters.

10. Further Development

The accuracy of swordfish age and growth studies would benefit immensely from a coordinated catch and release tagging program which incorporated chemical marking of hard-parts. Such a study would enable direct validation of increment formation and thus confirm what presently relies on indirect methods of increment validation. Present work towards developing appropriate techniques for handling and releasing swordfish in relation to archival tagging experiments may help towards resolving the problem of post handling mortality of swordfish.

The study showed the age of maturity for female swordfish in Australian waters was the highest reported yet for female swordfish. This result relied on interpretation of reproductive stage determined from histology (Young et al 2003). In that study the methodology used to obtain the resulting size at maturity, although justified, differed from other studies. As age at maturity is an important consideration in determining impacts of fishing, an evaluation of the histological criteria used to assign maturity stage to eggs in mature and maturing swordfish would help resolve uncertainty in the reproductive parameters used in stock assessments of this species. If our interpretation is correct it may help to explain the observed rapid declines in swordfish stocks elsewhere in the world.

To understand whether the smaller size classes of swordfish are the result of enhanced recruitment or to fishing impacts will need careful monitoring. The ongoing size monitoring work being carried out at processors along the eastern seaboard is the most cost effective way of following the size structure of the catch. The developing database should be able to identify significant long term changes in the size composition of the catch. As such this monitoring work should be continued and potential methodologies for identifying the sex of swordfish trunks post processing should be investigated.

Finally, the techniques and expertise developed for this and other studies by this organization in recent years could provide a platform for similar studies of target and bycatch species of the Eastern Tuna and Billfish fishery for which key population parameters are missing.

11. Intellectual Property

No intellectual property is claimed

12. Reports, publications and presentations

Written material

Young, J. W., Drake, A. and Groison, A. L. (2003) Age and Growth of Broadbill Swordfish (*Xiphias gladius*) from Eastern Australian Waters – preliminary results. BBRG 8 - SCTB 16, Mooloolaba July 9 -15 2003

Young, J. W., Drake, A. and Langridge, M. (in preparation for MFR) Age and growth of broadbill swordfish, *Xiphias gladius*, from Australian waters

Seminars

Young, J. W., Drake, A. and Groison, A. L. (2003) Age and Growth of Broadbill Swordfish (*Xiphias gladius*) from Eastern Australian Waters – preliminary results. BBRG 8 - SCTB 16, Mooloolaba July 9 -15 2003

Young, J. W. (2004) Age and Growth of Broadbill Swordfish (*Xiphias gladius*) from Australian Waters. 55th Annual Tuna Conference, Lake Arrowhead, California USA

Young, J. W. (2004) Age and Growth of Broadbill Swordfish (*Xiphias gladius*) from Australian Waters. 3rd International Otolith Symposium, Townsville

Staff

Staff	Position
Jock Young	Principal Investigator
Anita Drake	Laboratory technician
Anne-Laure Groisson	Research associate
Melissa Langridge	CSIRO Student scholar
Thor Carter	Field technician

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
13	06-Nov-98	-25.024999	154.375	153	176		3	2	1.0999	2
14	06-Nov-98	-25.024999	154.375	130	152		3	3	0.9000	3
15	06-Nov-98	-25.024999	154.375	100	118		1	3	0.7999	3
16	06-Nov-98	-25.024999	154.375	146	166		3	2	0.7000	2
17	06-Nov-98	-25.024999	154.375	153	171		3	3	0.3999	3
19	07-Nov-98	-25.383333	154.19999	170	192		6	3	0.2999	3
20	08-Nov-98	-25.583332	154.60000	153	175		6	3	0.2000	3
22	08-Nov-98	-25.583332	154.60000	154	179		5	3	0.3000	3
23	08-Nov-98	-25.583332	154.60000	87	101		1	3	0.6999	3
24	08-Nov-98	-25.583332	154.60000	176	195		6	2	0.4000	2
25	08-Nov-98	-25.583332	154.60000	209	228		7	3	0.5	3
26	08-Nov-98	-25.583332	154.60000	138	160		4	3	0.5	3
27	08-Nov-98	-25.583332	154.60000	115	132		3	1	0.2000	1
28	08-Nov-98	-25.583332	154.60000	157	180		6	3	0.5	3
29	09-Nov-98	-25.549999	154.875	170	191		5	2	0.4000	2
30	09-Nov-98	-25.549999	154.875	179	201		12	4	0.1999	4
31	09-Nov-98	-25.549999	154.875	90	104		1	2	0.6000	2
32	09-Nov-98	-25.549999	154.875	134	152		2	3	0.9000	3
34	29-Nov-98	-26.766666	155.10000	129	148		4	3	0.3000	3
35	29-Nov-98	-26.766666	155.10000	167	188		5	2	0.4000	2
36	29-Nov-98	-26.766666	155.10000	167	188		4	3	0.2000	3
38	29-Nov-98	-26.766666	155.10000	158	179		6	3	0.1999	3
39	30-Nov-98	-26.133333	155.125	136	155		3	3	0.2999	3
40	30-Nov-98	-26.133333	155.125	176	198		7	2	0.1999	2
41	30-Nov-98	-26.133333	155.125	138	157		4	3	0.4000	3
42	30-Nov-98	-26.133333	155.125	122	140		3	2	0.7999	2
43	30-Nov-98	-26.133333	155.125	173	195		6	3	0.1999	3
44	30-Nov-98	-26.133333	155.125	142	161		4	3	0.7000	3
80	27-Feb-95	-18	151	154	171		5	1	0.1999	1
81	12-Mar-95	-15	152	113	129		2	4	0.7999	4
82	09-Mar-95	-15	152	147	167	female	5	4	0.1999	4
83	10-Mar-95	-19	154	144	167	male	3	2	0.5999	2
84	30-Nov-98	-26.133333	155.125	162	183		7	3	0.0999	3
85	30-Nov-98	-26.133333	155.125	122	140		3	2	0.2000	2
86	06-Nov-98	-25.024999	154.375	145	163		3	2	0.9000	2
87	03-Sep-95				106		1	2	0.3999	2
88	03-Sep-95			125	145		3	2	0.9999	2
89	04-Sep-95	-35	159	187	207		7	2	0.8000	2
90	04-Sep-95	-35	159	117	132		2	2	0.6000	2
91	05-Sep-95	-30	158.5				2	2	1.1000	2
92	05-Sep-95	-30	158.5	122	140		2	2	1.2999	2
93	06-Sep-95	-30	159	169	196		4	2	0.2000	2
94	06-Sep-95	-30	159	129	146		2	3	1.1000	3
95	07-Sep-95	-30	159	103	117		1	2	0.9999	2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
96	07-Sep-95	-30	159	143	163		4	2	0.5	2
97	07-Sep-95	-30	159	179	202		4	2	0.5999	2
98	09-Sep-95	-30	158	174	193		4	2	0.3000	2
99	09-Sep-95	-30	158	169	189		4	2	0.3999	2
100	31-Jul-97	-32	155	141	160	male	3	2	0.5	2
101	08-Aug-97	-28.850000	158.57499	138	160	male	5	2	0.3000	2
102	20-Sep-99	-11	96	134	151	male		5		5
103	22-Sep-99	-12	108	92	108		2	3	0.22	3
104	20-Sep-99	-11	96	134	153		4	3	0.14	3
105	20-Sep-99	-11	96	90	106	female	2	4	0.19	4
106	20-Sep-99	-11	96	157	176	male	8	4	0.27	4
108	20-Sep-99	-11	96	129	145	female	5	3	0.3	3
109	17-Sep-99	-13	96	68	82	female	1	2	0.46	2
110	21-Oct-99	-27.75	155.85000	152	172	female	4	2		2
111	20-Oct-99	-27.466667	155.92500	148	168	female		5		5
112	20-Oct-99	-27.466667	155.92500	166	187	female	4	2		2
113	20-Oct-99	-27.466667	155.92500	143	163	male	5	3		3
115	22-Oct-99	-27.783332	155.82501	138	157	female	6	3	0.33	3
116	21-Oct-99	-27.75	155.85000	150	170	female	4	3		3
118	20-Oct-99	-27.466667	155.92500	220	245	female	11	4	0.26	4
119	21-Oct-99	-27.75	155.85000	162	183	male	9	4	0.06	4
120	21-Oct-99	-27.75	155.85000	167	188	female	7	4	0.77	4
121	20-Oct-99	-27.466667	155.92500	195	218	female	7	3	0.38	3
122	20-Oct-99	-27.466667	155.92500	125	143	male	3	4	0.15	4
124	22-Oct-99	-27.783332	155.82501	157	177	male	5	2		2
125	22-Oct-99	-27.783332	155.82501	162	183	female	7	4		4
126	21-Oct-99	-27.75	155.85000	130	149	female	5	1		1
127	22-Oct-99	-27.783332	155.82501	208	232	female	7	2	0.39	2
128	21-Oct-99	-27.75	155.85000	163	184	female	7	3	0.22	3
129	22-Oct-99	-27.783332	155.82501	187	209	male	10	3	0.22	3
131	22-Oct-99	-27.783332	155.82501	198	221	female	7	2		2
132	21-Oct-99	-27.75	155.85000	155	175	female	5	2		2
133	22-Oct-99	-27.783332	155.82501	159	180	male	5	2		2
134	21-Oct-99	-27.75	155.85000	196	219	female	11	3	0.14	3
135	22-Oct-99	-27.783332	155.82501	113	131	female	5	2	0.27	2
136	22-Oct-99	-27.783332	155.82501	153	173	male	7	2	0.25	2
137	22-Oct-99	-27.783332	155.82501	160	181	female	7	3	0.18	3
138	22-Oct-99	-27.783332	155.82501	151	171	male	6	1	0.25	1
139	22-Oct-99	-27.783332	155.82501	168	189	male	7	2		2
140	22-Oct-99	-27.783332	155.82501	193	216	female	8	3	0.39	3
141	22-Oct-99	-27.783332	155.82501	179	201	male	9	2	0.14	2
142	22-Oct-99	-27.783332	155.82501	108	125	male	5	3	0.21	3
143	18-Oct-99	-27.200000	155.08332	167	188	female	6	2		2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
144	21-Oct-99	-27.75	155.85000	148	168	female	4	2	0.1	2
145	19-Oct-99	-27.549999	155.76666	137	156	female	6	3		3
146	19-Oct-99	-27.549999	155.76666	192	215	male	8	2	0.27	2
147	21-Oct-99	-27.75	155.85000	162	183	male	8	3	0.22	3
148	21-Oct-99	-27.75	155.85000	195	218	female	9	1	0.27	1
149	21-Oct-99	-27.75	155.85000	200	223	female	12	2		2
150	19-Oct-99	-27.549999	155.76666	126	144	female	2	1		1
151	18-Oct-99	-27.200000	155.08332	136	155	female	5	2	0.1	2
152	20-Oct-99	-27.466667	155.92500	169	190	male	7	4		4
153	21-Oct-99	-27.75	155.85000	123	141	male	4	4	0.27	4
154	21-Oct-99	-27.75	155.85000	129	148	female	3	2		2
155	18-Oct-99	-27.200000	155.08332	172	193	female	9	3		3
156	18-Oct-99	-27.200000	155.08332	201	224	female	8	2		2
157	20-Oct-99	-27.466667	155.92500	168	189	male	6	4	0.4	4
158	21-Oct-99	-27.75	155.85000	173	195	male	6	3		3
159	19-Oct-99	-27.549999	155.76666	143	163	female	6	3	0.59	3
160	18-Oct-99	-27.200000	155.08332	109	126	female	3	1		1
161	21-Oct-99	-27.75	155.85000	230	255	female	12	3	0.3	3
162	21-Oct-99	-27.75	155.85000	166	187	female	5	2		2
163	21-Oct-99	-27.75	155.85000	120	138	female	3	2		2
164	20-Oct-99	-27.466667	155.92500	180	202	male	6	4		4
165	18-Oct-99	-27.200000	155.08332	102	119	male	3	3	0.2	3
166	21-Oct-99	-27.75	155.85000	168	189	female	8	3		3
170	17-Oct-99	-27.083332	154.80833	164	185	male	7	4		4
171	19-Dec-99	-27.383335	157.70834	209	233	female	9	2	0.18	2
172	20-Dec-99	-28.566665	157.42500	184	206	female	10	2	0.1	2
173	20-Dec-99	-28.566665	157.42500	206	230	female	9	4	0.49	4
174	16-Dec-99	-28.558332	158.25833	195	218	female	8	3		3
175	17-Dec-99	-28.741666	157.75833	202	225	female	9	3		3
176	17-Dec-99	-28.741666	157.75833	189	212	female	8	3	0.3	3
177	18-Dec-99	-28.875	157.74166	157	177	female	6	2	0.11	2
178	17-Dec-99	-28.741666	157.75833	109	126	female	2	3	0.47	3
179	16-Dec-99	-28.558332	158.25833	175	197	female	9	2	0.07	2
180	17-Dec-99	-28.741666	157.75833	135	154	female	4	2	0.33	2
181	18-Dec-99	-28.875	157.74166	195	218	female	7	2	0.41	2
182	18-Dec-99	-28.875	157.74166	156	176	male	6	4		4
183	20-Dec-99	-28.566665	157.42500	122	140	female	2	2	0.52	2
184	18-Dec-99	-28.875	157.74166	171	192	female	7	3		3
186	18-Oct-99	-27.200000	155.08332	152	172	male	7	2	0.15	2
187	17-Oct-99	-27.083332	154.80833	132	151	female	6	3		3
188	16-Oct-99	-26.383333	154.91667	127	146	female	4	2	0.1	2
189	17-Oct-99	-27.083332	154.80833	152	172	male	6	2		2
191	18-Oct-99	-27.200000	155.08332	110	127	male	2	2	0.62	2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
192	17-Oct-99	-27.083332	154.80833	121	141	female	6	4	0.31	4
193	19-Dec-99	-27.383335	157.70834	131	150	female	4	2	0.3	2
195	18-Dec-99	-28.875	157.74166	263	290	female	15	3		3
196	16-Dec-99	-28.558332	158.25833	257	284	female	15	4	0.16	4
197	21-Dec-99	-28.599998	157.23333	174	196	female	7	4	0.18	4
198	19-Dec-99	-27.383335	157.70834	150	170	male	5	3		3
199	21-Dec-99	-28.599998	157.23333	164	185	male	8	3	0.12	3
200	20-Dec-99	-28.566665	157.42500	133	152	female		5		5
201	17-Dec-99	-28.741666	157.75833	197	220	female	8	4	0.42	4
202	18-Dec-99	-28.875	157.74166	217	241	female	11	3	0.18	3
203	17-Dec-99	-28.741666	157.75833	150	170	female	6	3		3
204	17-Dec-99	-28.741666	157.75833	156	176	male	6	2	0.28	2
205	21-Dec-99	-28.599998	157.23333	179	201	female	6	3		3
206	18-Dec-99	-28.875	157.74166	163	184	male	5	2	0.42	2
207	18-Dec-99	-28.875	157.74166	177	199	male	5	4	0.25	4
208	18-Dec-99	-28.875	157.74166	150	170	female	5	2		2
209	18-Dec-99	-28.875	157.74166	160	181	female	6	3	0.24	3
210	20-Dec-99	-28.566665	157.42500	133	152	female	4	1		1
211	16-Dec-99	-28.558332	158.25833	210	234	female	10	4	0.16	4
212	19-Dec-99	-27.383335	157.70834	175	197	female	10	4	0.37	4
213	16-Dec-99	-28.558332	158.25833	140	159	female	4	2	0.44	2
214	16-Dec-99	-28.558332	158.25833	212	236	female	11	4		4
215	20-Dec-99	-28.566665	157.42500	159	180	female	6	3	0.41	3
217	18-Feb-00	-28.858333	160.29167	149	169	female	5	2	0.64	2
218	12-Feb-00	-27.591667	160.28332			female	9	3		3
219	24-Feb-00	-28.875	160.23333	220	245	female	11	4	0.32	4
220	12-Feb-00	-27.591667	160.28332	214	238	female	9	4	0.13	4
221	12-Feb-00	-27.591667	160.28332	207	231	male	8	4		4
222	22-Feb-00	-28.908332	160.39166	161	182	female	6	2	0.64	2
223	22-Feb-00	-28.908332	160.39166	104	121	female	3	2	0.44	2
224	18-Feb-00	-28.858333	160.29167	219	244	female	11	4	0.2	4
225	14-Feb-00	-28.233333	160.27499	213	237	female	7	3		3
226	14-Feb-00	-28.233333	160.27499	120	138	female	4	3	0.28	3
227	22-Feb-00	-28.908332	160.39166	181	203	female	6	2	0.13	2
228	14-Feb-00	-28.233333	160.27499	230	255	female		5		5
229	14-Feb-00	-28.233333	160.27499	162	183	female	6	3	0.23	3
230	14-Feb-00	-28.233333	160.27499	177	199	male	7	2	0.17	2
231	22-Feb-00	-28.908332	160.39166	172	193	male	8	4		4
232	14-Feb-00	-28.233333	160.27499	147	167	female	4	2	0.28	2
233	22-Feb-00	-28.908332	160.39166	148	168	male	7	3	0.22	3
234	14-Feb-00	-28.233333	160.27499	134	153	female	4	2	0.24	2
235	22-Feb-00	-28.908332	160.39166	153	173	female	5	2	0.33	2
237	22-Feb-00	-28.908332	160.39166	212	236	female	8	3	0.4	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
238	22-Feb-00	-28.908332	160.39166	141	160	female	6	2	0.25	2
239	22-Feb-00	-28.908332	160.39166	102	119	female	3	2	0.34	2
240	22-Feb-00	-28.908332	160.39166	134	153	female	4	2	0.35	2
241	14-Feb-00	-28.233333	160.27499	142	161	male	4	2	0.49	2
242	22-Feb-00	-28.908332	160.39166	108	125	male	2	2	0.3	2
244	14-Feb-00	-28.233333	160.27499	162	183	male	5	3	0.17	3
245	22-Feb-00	-28.908332	160.39166	142	161	female	5	3	0.16	3
246	22-Feb-00	-28.908332	160.39166	100	117	male	3	2	0.18	2
247	14-Feb-00	-28.233333	160.27499	165	186	male	6	2	0.3	2
248	23-Feb-00	-28.966667	160.39999	106	123	female	4	2	0.16	2
249	14-Feb-00	-28.233333	160.27499	147	167	male	4	2	0.45	2
250	14-Feb-00	-28.233333	160.27499	109	126	male	3	3	0.09	3
251	22-Feb-00	-28.908332	160.39166	99	116	female	2	4		4
252	17-Feb-00	-28.575000	160.31668	165	186	female	6	3	0.19	3
253	17-Feb-00	-28.575000	160.31668	104	121	male	2	4	0.4	4
254	18-Feb-00	-28.858333	160.29167	101	118	male	4	4		4
255	17-Feb-00	-28.575000	160.31668	125	143	female	4	3	0.42	3
256	18-Feb-00	-28.858333	160.29167	109	126	female	2	3	0.33	3
257	12-Feb-00	-27.591667	160.28332	123	141	female	3	3	0.14	3
258	17-Feb-00	-28.575000	160.31668	107	124	male	2	2	0.33	2
259	17-Feb-00	-28.575000	160.31668	118	136	female	4	4	0.29	4
260	13-Feb-00	-27.408332	160.43333	153	173	male	5	3	0.26	3
261	13-Feb-00	-27.408332	160.43333	120	138	female	3	4	0.28	4
262	13-Feb-00	-27.408332	160.43333	179	201	male	6	2	0.17	2
263	13-Feb-00	-27.408332	160.43333	177	199	male	10	3	0.13	3
264	19-Feb-00	-28.841667	160.29165	147	167	female	5	4	0.3	4
265	19-Feb-00	-28.841667	160.29165	176	198	female	7	3	0.34	3
266	13-Feb-00	-27.408332	160.43333	165	186	female	7	1	0.34	1
267	17-Feb-00	-28.575000	160.31668	118	136	male	2	2	0.1	2
268	18-Feb-00	-28.858333	160.29167	103	120	female	3	4	0.56	4
269	12-Feb-00	-27.591667	160.28332	154	174	female	6	3	0.32	3
270	19-Feb-00	-28.841667	160.29165	146	166	female	5	3	0.2	3
271	18-Feb-00	-28.858333	160.29167	190	213	female	8	3	0.22	3
272	13-Feb-00	-27.408332	160.43333	119	137	male	3	4		4
273	14-Feb-00	-28.233333	160.27499	233	259	female	11	3		3
274	17-Feb-00	-28.575000	160.31668	102	119	male	2	3	0.29	3
275	13-Feb-00	-27.408332	160.43333	113	131	female	4	4	0.42	4
276	13-Feb-00	-27.408332	160.43333	189	212	male	11	4	0.11	4
277	12-Feb-00	-27.591667	160.28332	121	139	female	6	2	0.21	2
278	17-Feb-00	-28.575000	160.31668	122	140	female	3	4	0.43	4
279	19-Feb-00	-28.841667	160.29165	167	188	male	6	3	0.28	3
280	13-Feb-00	-27.408332	160.43333	124	142	male	3	4	0.36	4
281	13-Feb-00	-27.408332	160.43333	103	120	male	2	4	0.34	4

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
282	19-Feb-00	-28.841667	160.29165	130	149	female	3	3	0.26	3
283	17-Feb-00	-28.575000	160.31668	165	186	male	8	2	0.45	2
284	19-Feb-00	-28.841667	160.29165	180	202	female	8	2	0.25	2
285	13-Feb-00	-27.408332	160.43333	173	195	male	7	3	0.13	3
286	12-Feb-00	-27.591667	160.28332	117	135	female	3	2	0.33	2
287	17-Feb-00	-28.575000	160.31668	127	146	female	4	4		4
288	13-Feb-00	-27.408332	160.43333	175	197	male	9	3	0.31	3
289	19-Feb-00	-28.841667	160.29165	171	192	male	9	3		3
290	19-Feb-00	-28.841667	160.29165	188	211	male	5	4	0.29	4
291	13-Feb-00	-27.408332	160.43333	114	132	male	2	2	0.45	2
292	12-Feb-00	-27.591667	160.28332	181	203	male	7	2		2
293	18-Feb-00	-28.858333	160.29167	143	163	female	4	3	0.32	3
294	19-Feb-00	-28.841667	160.29165	119	137	male	2	4		4
295	19-Feb-00	-28.841667	160.29165	177	199	female	8	3	0.22	3
296	13-Feb-00	-27.408332	160.43333	157	177	female	6	3	0.26	3
297	24-Feb-00	-28.875	160.23333	222	247	female	9	3	0.3	3
298	20-Feb-00	-28.783332	160.25	190	213	female	8	3	0.28	3
299	20-Feb-00	-28.783332	160.25	170	191	female	6	4	0.46	4
300	20-Feb-00	-28.783332	160.25	216	240	female	9	3		3
301	20-Feb-00	-28.783332	160.25	162	183	male	4	3	0.19	3
302	20-Feb-00	-28.783332	160.25	142	161	male	4	2	0.16	2
303	20-Feb-00	-28.783332	160.25	100	117	female	2	4		4
304	21-Feb-00	-28.908332	160.51666	194	217	female	10	3	0.08	3
305	21-Feb-00	-28.908332	160.51666	117	135	male	4	4	0.25	4
306	21-Feb-00	-28.908332	160.51666	213	237	female	12	3	0.17	3
307	21-Feb-00	-28.908332	160.51666	218	243	female	12	4	0.3	4
308	21-Feb-00	-28.908332	160.51666	161	182	female	7	4	0.09	4
309	20-Feb-00	-28.783332	160.25	233	259	female	13	4	0.05	4
310	21-Feb-00	-28.908332	160.51666	146	166	female	6	4	0.18	4
311	21-Feb-00	-28.908332	160.51666	184	206	male	8	4	0.24	4
312	21-Feb-00	-28.908332	160.51666	152	172	male	5	3	0.71	3
313	21-Feb-00	-28.908332	160.51666	141	160	female	4	4	0.35	4
314	21-Feb-00	-28.908332	160.51666	152	172	male	1	4	0.85	4
315	21-Feb-00	-28.908332	160.51666	122	140	female	4	3	0.22	3
316	21-Feb-00	-28.908332	160.51666	133	152	female	4	4		4
317	21-Feb-00	-28.908332	160.51666	168	189	female	6	3	0.26	3
318	20-Feb-00	-28.783332	160.25	103	120	female	3	1	0.17	1
319	20-Feb-00	-28.783332	160.25	146	166		4	1	0.2	1
320	20-Feb-00	-28.783332	160.25	146	166	female	5	2	0.2	2
321	21-Feb-00	-28.908332	160.51666	118	136	male		5		5
322	20-Feb-00	-28.783332	160.25	131	150	female	3	3	0.23	3
324	21-Feb-00	-28.908332	160.51666	131	150	female	5	3	0.22	3
325	20-Feb-00	-28.783332	160.25	152	172	female	5	3	0.2	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
326	21-Feb-00	-28.908332	160.51666	161	182	female	6	3	0.12	3
327	21-Feb-00	-28.908332	160.51666	207	231	female	9	3	0.46	3
328	21-Feb-00	-28.908332	160.51666	145	165	female	3	3	0.15	3
329	21-Feb-00	-28.908332	160.51666	228	253	female	10	4		4
330	21-Feb-00	-28.908332	160.51666	157	177	female	6	4	0.31	4
331	21-Feb-00	-28.908332	160.51666	197	220	female	9	3		3
332	21-Feb-00	-28.908332	160.51666	171	192	female	6	2		2
333	21-Feb-00	-28.908332	160.51666	175	197	female	7	3		3
334	21-Feb-00	-28.908332	160.51666	205	229	female	10	4	0.13	4
335	23-Feb-00	-28.966667	160.39999	194	217	female	9	3		3
336	23-Feb-00	-28.966667	160.39999	194	217	male	9	2	0.15	2
337	23-Feb-00	-28.966667	160.39999	101	118	female	2	2	0.53	2
338	23-Feb-00	-28.966667	160.39999	141	160	female	6	4	0.27	4
339	24-Feb-00	-28.875	160.23333	106	123	female	3	4	0.05	4
340	23-Feb-00	-28.966667	160.39999	151	171	female	5	2		2
341	23-Feb-00	-28.966667	160.39999	104	121	male	3	3		3
342	16-Feb-00	-28.458333	160.47500	141	160	female	7	4	0.13	4
343	16-Feb-00	-28.458333	160.47500	109	126	male	4	2	0.14	2
345	16-Feb-00	-28.458333	160.47500	118	136	female	3	3		3
346	16-Feb-00	-28.458333	160.47500	232	257	female	11	2	0.12	2
348	18-Feb-00	-28.858333	160.29167	160	181	female	8	2		2
349	16-Feb-00	-28.458333	160.47500	106	123	female	3	4	0.16	4
350	16-Feb-00	-28.458333	160.47500	106	123	female	3	2		2
352	16-Feb-00	-28.458333	160.47500	100	117	female	3	4	0.21	4
353	18-Feb-00	-28.858333	160.29167	161	182	male	7	3		3
354	18-Feb-00	-28.858333	160.29167	171	192	female	6	3		3
355	16-Feb-00	-28.458333	160.47500	196	219	female	8	4		4
356	16-Feb-00	-28.458333	160.47500	150	170	male	4	3		3
357	12-Feb-00	-27.591667	160.28332	116	134	male	5	2		2
358	16-Feb-00	-28.458333	160.47500	100	117	male	1	2		2
359	16-Feb-00	-28.458333	160.47500	170	191	female	7	2		2
360	16-Feb-00	-28.458333	160.47500	141	160	female	8	4	0.32	4
361	16-Feb-00	-28.458333	160.47500	210	234	female	11	3	0.22	3
362	16-Feb-00	-28.458333	160.47500	197	220	female	13	4	0.07	4
363	21-Dec-99	-28.599998	157.23333	226	251	female	8	4	0.36	4
364	22-May-00	-20.450000	153.46667	154	174	male	6	4		4
365	24-May-00	-20.575000	153.75833	115	133	female	4	4	0.18	4
366	27-May-00	-23.649999	154.55000	113	131	male	2	4		4
367	27-May-00	-23.649999	154.55000	124	142	female	3	2		2
368	27-May-00	-23.649999	154.55000	126	144	female	4	4		4
369	27-May-00	-23.649999	154.55000	110	127	female	4	3		3
370	27-May-00	-23.649999	154.55000	113	131	female		5		5
371	24-May-00	-20.575000	153.75833	128	147	male	5	2	0.24	2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
372	24-May-00	-20.575000	153.75833	101	118	male		5		5
373	24-May-00	-20.575000	153.75833	137	156	male	5	4	0.39	4
374	25-May-00	-20.983333	154.76666	148	168	female	4	4	0.56	4
375	22-May-00	-20.450000	153.46667	150	170	male	5	4	0.05	4
376	24-May-00	-20.575000	153.75833	119	137	female	4	2	0.15	2
377	22-May-00	-20.450000	153.46667	145	165	female		5		5
378	22-May-00	-20.450000	153.46667	168	189	male	9	4		4
379	26-May-00	-22.158332	154.47500	123	141	female	3	4	0.53	4
380	26-May-00	-22.158332	154.47500	115	133	male	3	3	0.29	3
381	23-May-00	-20.191665	153.5	130	149	male	4	4	0.43	4
382	22-May-00	-20.450000	153.46667	105	122	male	3	3	0.33	3
383	25-May-00	-20.983333	154.76666	171	192	male	8	3	0.37	3
384	23-May-00	-20.191665	153.5	123	141	male	1	4		4
385	24-May-00	-20.575000	153.75833	125	143		2	3	0.53	3
386	26-May-00	-22.158332	154.47500	130	149	female	4	4	1.01	4
387	25-May-00	-20.983333	154.76666	126	144	female	3	3	0.2	3
388	26-May-00	-22.158332	154.47500	137	156	female	2	4	0.22	4
389	26-May-00	-22.158332	154.47500	109	126	female	3	2	0.22	2
390	23-May-00	-20.191665	153.5	131	150	male	4	4	0.48	4
391	23-May-00	-20.191665	153.5	125	143	male	3	3	0.14	3
392	23-May-00	-20.191665	153.5	153	173	male	7	3	0.18	3
393	22-May-00	-20.450000	153.46667	95	111	female	1	3	0.49	3
394	22-May-00	-20.450000	153.46667	108	125	female	3	3	0.27	3
395	23-May-00	-20.191665	153.5	99	116	female	2	3	0.41	3
396	24-May-00	-20.575000	153.75833	210	234	female	11	3	0.25	3
397	21-May-00	-20.283332	153.55000	125	143		3	2	0.34	2
398	21-May-00	-20.283332	153.55000	152	172		3	3	0.12	3
399	27-May-00	-23.649999	154.55000	92	108		2	3	0.36	3
400	22-May-00	-20.450000	153.46667	152	172					
401	17-Dec-99	-28.741666	157.75833	166	187	female	8	4		4
402	11-Sep-00	-25.950000	160.13333	202	225	female	8	3	0.26	3
403	10-Sep-00	-27.183332	161.18333	176	198	female	7	3	0.42	3
404	07-Sep-00	-27	161.26666	140	159	male	6	4	0.29	4
405	08-Sep-00	-27.183332	161.18333	101	118	female	2	4	0.39	4
406	07-Sep-00	-27	161.26666	183	205	male	9	4	0.39	4
407	08-Sep-00	-27.183332	161.18333	117	135	female	3	3	0.42	3
408	08-Sep-00	-27.183332	161.18333	168	189	male	7	4	0.37	4
409	07-Sep-00	-27	161.26666	104	121	female	2	3	0.6	3
410	08-Sep-00	-27.183332	161.18333	186	208	female	7	3	0.39	3
411	08-Sep-00	-27.183332	161.18333	131	150	female	3	4	0.18	4
412	08-Sep-00	-27.183332	161.18333	183	205	female	10	2	0.15	2
413	08-Sep-00	-27.183332	161.18333	133	152	male	5	2	0.21	2
414	10-Sep-00	-27.183332	161.18333	129	148	female	7	2	0.16	2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
415	10-Sep-00	-27.183332	161.18333	134	153	male	5	3	0.31	3
416	10-Sep-00	-27.183332	161.18333	110	127	female	2	1	0.42	1
417	10-Sep-00	-27.183332	161.18333	144	164	male	4	3	0.23	3
418	10-Sep-00	-27.183332	161.18333	182	204	male	7	4	0.03	4
419	10-Sep-00	-27.183332	161.18333	109	126	female		5		5
420	10-Sep-00	-27.183332	161.18333	135	154	male	6	3	0.2	3
421	11-Sep-00	-25.950000	160.13333	148	168	female	4	4	0.34	4
422	10-Sep-00	-27.183332	161.18333	150	170	female		5		5
423	11-Sep-00	-25.950000	160.13333	154	174	female	7	4	0.04	4
424	10-Sep-00	-27.183332	161.18333	126	144	female	5	4	0.43	4
425	11-Sep-00	-25.950000	160.13333	136	155	female	5	4	0.36	4
426	11-Sep-00	-25.950000	160.13333	138	157	female	4	3	0.21	3
427	11-Sep-00	-25.950000	160.13333	131	150	female	8	4	0.1	4
428	11-Sep-00	-25.950000	160.13333	172	193	male	10	3	0.32	3
429	11-Sep-00	-25.950000	160.13333	184	206	male	12	3		3
430	11-Sep-00	-25.950000	160.13333	108	125	female	2	1	0.54	1
431	13-Sep-00	-25.516666	160.33332	190	213	female	8	4		4
432	11-Sep-00	-25.950000	160.13333	148	168	female	4	4		4
433	13-Sep-00	-25.516666	160.33332	110	127	male	4	3	0.27	3
434	13-Sep-00	-25.516666	160.33332	159	180	female	5	2	0.57	2
435	13-Sep-00	-25.516666	160.33332	140	159	female	6	3	0.3	3
436	13-Sep-00	-25.516666	160.33332	156	176	female	6	2	0.36	2
438	13-Sep-00	-25.516666	160.33332	155	175	female	6	2	0.09	2
439	13-Sep-00	-25.516666	160.33332	233	259	female	11	2		2
440	13-Sep-00	-25.516666	160.33332	113	131	male	5	2	0.36	2
441	13-Sep-00	-25.516666	160.33332	127	146	male	7	3	0.11	3
442	13-Sep-00	-25.516666	160.33332	220	245	female	12	3	0.13	3
443	13-Sep-00	-25.516666	160.33332	108	125	female	3	2	0.04	2
444	13-Sep-00	-25.516666	160.33332	163	184	male	5	4		4
445	13-Sep-00	-25.516666	160.33332	161	182	female	4	4	0.43	4
446	13-Sep-00	-25.516666	160.33332	165	186	female	7	4	0.15	4
447	13-Sep-00	-25.516666	160.33332	109	126	male	3	2	0.11	2
448	13-Sep-00	-25.516666	160.33332	142	161	female	4	3	0.17	3
449	13-Sep-00	-25.516666	160.33332	123	141	female	5	3	0.14	3
450	14-Sep-00	-26.966667	160.36666	190	213	female	10	4		4
451	13-Sep-00	-25.516666	160.33332	164	185	female	10	4	0.05	4
452	14-Sep-00	-26.966667	160.36666	125	143	female	7	4	0.36	4
453	14-Sep-00	-26.966667	160.36666	157	177	female	7	4		4
454	14-Sep-00	-26.966667	160.36666	98	115	female	2	2	0.36	2
455	14-Sep-00	-26.966667	160.36666	120	138	female	4	3	0.13	3
456	14-Sep-00	-26.966667	160.36666	126	144	male	5	3	0.54	3
457	14-Sep-00	-26.966667	160.36666	182	204	male	8	3	0.25	3
458	16-Sep-00	-25.566667	160.33332	193	216	female	11	3	0.21	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
460	16-Sep-00	-25.566667	160.33332	170	191	female	6	3	0.27	3
461	16-Sep-00	-25.566667	160.33332	120		male		5		5
462	16-Sep-00	-25.566667	160.33332	95	111	male	2	2	0.2	2
463	16-Sep-00	-25.566667	160.33332	161	182	female	7	3	0.03	3
464	16-Sep-00	-25.566667	160.33332	232	257	female	10	4	0.36	4
465	16-Sep-00	-25.566667	160.33332	188	211	female	10	4	0.24	4
466	16-Sep-00	-25.566667	160.33332	195	218	male	5	2	0.05	2
467	16-Sep-00	-25.566667	160.33332	120	138	female	3	3	0.19	3
468	16-Sep-00	-25.566667	160.33332	132	151	female	6	4	0.29	4
469	16-Sep-00	-25.566667	160.33332	111	128	female	3	2	0.09	2
470	16-Sep-00	-25.566667	160.33332	144	164	female	4	2	0.07	2
471	16-Sep-00	-25.566667	160.33332	176	198	female		5		5
472	16-Sep-00	-25.566667	160.33332	198	221	female	7	2	0.49	2
473	17-Sep-00	-25.649999	160.68333	101	118	female	3	3	0.4	3
474	17-Sep-00	-25.649999	160.68333	184	206	female	6	4	0.4	4
475	17-Sep-00	-25.649999	160.68333	124	142	male	3	3	0.22	3
476	17-Sep-00	-25.649999	160.68333	120	138	female	4	3	0.11	3
477	17-Sep-00	-25.649999	160.68333	168	189	male	11	4	0.1	4
478	17-Sep-00	-25.649999	160.68333	162	183	female	7	3	0.35	3
479	17-Sep-00	-25.649999	160.68333	116	134	female	3	3	0.57	3
480	17-Sep-00	-25.649999	160.68333	149	169	female	5	4		4
481	17-Sep-00	-25.649999	160.68333	114	132	female	0	2		2
482	17-Sep-00	-25.649999	160.68333	116		female	5	3	0.48	3
484	17-Sep-00	-25.649999	160.68333	178	200	female	8	3	0.1	3
485	17-Sep-00	-25.649999	160.68333	180	202	male	8	4		4
486	18-Sep-00	-25.75	160.45834	177	199	male	10	4	0.1	4
487	17-Sep-00	-25.649999	160.68333	150	170	male	6	3	0.06	3
488	18-Sep-00	-25.75	160.45834	133	152	female	5	3		3
489	18-Sep-00	-25.75	160.45834	191	214	male	8	4	0.3	4
490	18-Sep-00	-25.75	160.45834	173	195	female	6	2		2
491	18-Sep-00	-25.75	160.45834	104	121	female	4	2		2
492	18-Sep-00	-25.75	160.45834	123	141	female	4	2	0.1	2
493	18-Sep-00	-25.75	160.45834	149	169	female	5	2	0.04	2
494	18-Sep-00	-25.75	160.45834	157	177	male	7	3	0.07	3
495	18-Sep-00	-25.75	160.45834	122	140	female	4	3	0.05	3
496	18-Sep-00	-25.75	160.45834	141	160	female	4	3	0.16	3
497	18-Sep-00	-25.75	160.45834	141	160	female	6	3	0.09	3
498	18-Sep-00	-25.75	160.45834	131	150	male	2	3	0.83	3
499	18-Sep-00	-25.75	160.45834	167	188	male		5		5
500	18-Sep-00	-25.75	160.45834	105	122	male	1	3	0.09	3
501	07-Sep-00	-27	161.26666	123	141	female	4	3		3
502	07-Sep-00	-27	161.26666	178	200	male	8	4	0.07	4
503	07-Sep-00	-27	161.26666	193	216	male	9	3	0.28	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
504	07-Sep-00	-27	161.26666	157	177	female	6	3	0.21	3
505	07-Sep-00	-27	161.26666	235	261	female	7	3	0.29	3
506	07-Sep-00	-27	161.26666	119	137	female	3	2	0.26	2
507	07-Sep-00	-27	161.26666	88	104	female	1	2	0.56	2
508	07-Sep-00	-27	161.26666	137	156	female	5	2	0.57	2
509	07-Sep-00	-27	161.26666	188	211	male		5		5
510	07-Sep-00	-27	161.26666	174	196	male		5		5
511	07-Sep-00	-27	161.26666	116	134	male	2	3		3
512	08-Sep-00	-27.183332	161.18333	180	202	female	10	4	0.1	4
513	08-Sep-00	-27.183332	161.18333	176	198	female	7	2	0.1	2
514	08-Sep-00	-27.183332	161.18333	117	135	female	4	2	0.06	2
515	08-Sep-00	-27.183332	161.18333	121	139	female	3	2	0.07	2
516	08-Sep-00	-27.183332	161.18333	176	198	female	7	3	0.62	3
517	15-Sep-00	-25.316667	160.39999	118	136	female	3	4	0.27	4
518	08-Sep-00	-27.183332	161.18333	190	213	female	8	2	0.37	2
519	15-Sep-00	-25.316667	160.39999	165	186	female	6	3	0.1	3
520	15-Sep-00	-25.316667	160.39999	179	201	female	9	2	0.37	2
521	15-Sep-00	-25.316667	160.39999	120	138	female	4	2	0.26	2
522	15-Sep-00	-25.316667	160.39999	178	200	female	9	3	0.26	3
523	15-Sep-00	-25.316667	160.39999	166	187	male		5		5
524	15-Sep-00	-25.316667	160.39999	138	157	female	7	3	0.13	3
525	15-Sep-00	-25.316667	160.39999	201	224	female	10	3	0.18	3
526	15-Sep-00	-25.316667	160.39999	140	159	female	8	2	0.06	2
527	15-Sep-00	-25.316667	160.39999	153	173	female	7	3	0.47	3
528	15-Sep-00	-25.316667	160.39999	183	205	female	8	3	0.28	3
529	12-Sep-00	-25.716667	160.21665	172	193	female	5	3	0.41	3
530	14-Sep-00	-26.966667	160.36666	179	201	female	11	4	0.08	4
531	12-Sep-00	-25.716667	160.21665	137	156	male	5	2	0.22	2
532	12-Sep-00	-25.716667	160.21665	182	204	female	8	3	0.1	3
533	12-Sep-00	-25.716667	160.21665	171	192	male	7	3	0.26	3
534	12-Sep-00	-25.716667	160.21665	121	139	female	5	3	0.15	3
535	12-Sep-00	-25.716667	160.21665	132	151	female	7	3	0.06	3
536	12-Sep-00	-25.716667	160.21665	100	117	female	2	2	0.05	2
537	12-Sep-00	-25.716667	160.21665	111	128	female	3	2	0.15	2
538	12-Sep-00	-25.716667	160.21665	158	179	female		5		5
539	12-Sep-00	-25.716667	160.21665	127	146	female	5	2	0.08	2
540	12-Sep-00	-25.716667	160.21665	209	233	female	11	3	0.17	3
541	12-Sep-00	-25.716667	160.21665	126	144	female	4	4	0.05	4
542	12-Sep-00	-25.716667	160.21665	146	166	female	4	4		4
543	14-Sep-00	-26.966667	160.36666	114	132	male	3	4	0.08	4
544	14-Sep-00	-26.966667	160.36666	147	167	male	4	3	0.34	3
545	14-Sep-00	-26.966667	160.36666	136	155	female	4	2	0.23	2
546	14-Sep-00	-26.966667	160.36666	113	131	female	5	3	0.3	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
547	14-Sep-00	-26.966667	160.36666	149	169	female	5	3	0.59	3
548	12-Sep-00	-25.716667	160.21665	105	122	male		5	0.24	5
549	14-Sep-00	-26.966667	160.36666	270	298	female		5		5
550	14-Sep-00	-26.966667	160.36666	211	235	female	9	4	0.44	4
551	15-Sep-00	-25.316667	160.39999	93	109		2	2		2
553	04-Dec-00	-24.799999	154.16667	170	191	male	9	4	0.27	4
554	04-Dec-00	-24.799999	154.16667	165	186	male	6	4	0.39	4
555	07-Dec-00	-24.474998	153.55833	110	127	male	5	2	0.25	2
557	07-Dec-00	-24.474998	153.55833	101	118	male	3	3	0.35	3
558	08-Dec-00	-24.233333	153.56666	111	128	male	2	3	0.43	3
559	08-Dec-00	-24.233333	153.56666	102	119	male	2	4	0.19	4
560	08-Dec-00	-24.233333	153.56666	110	127	female	2	2	0.56	2
561	08-Dec-00	-24.233333	153.56666	138	157	female	6	4	0.16	4
562	08-Dec-00	-24.233333	153.56666	175	197	male	10	3	0.1	3
563	08-Dec-00	-24.233333	153.56666	126	144	male	5	3	0.12	3
565	08-Dec-00	-24.233333	153.56666	213	237	female	10	3	0.21	3
566	05-Jan-01	-29.299999	155.66667	123	141	male	3	2	0.3	2
567	05-Jan-01	-29.299999	155.66667	123	141	female	2	2	0.53	2
568	05-Jan-01	-29.299999	155.66667	95	111	female	1	4	0.65	4
569	06-Jan-01	-28.625	154.10000	132	151	female	4	3	0.21	3
570	06-Jan-01	-28.625	154.10000	91	107	male	1	1	0.15	1
571	05-Jan-01	-29.299999	155.66667	88	104	female	1	2	0.41	2
572	05-Jan-01	-29.299999	155.66667	160	181	female	8	3		3
573	05-Jan-01	-29.299999	155.66667	177	199	female	7	3	0.25	3
574	06-Jan-01	-28.625	154.10000	112	130	male	2	3	0.46	3
575	06-Jan-01	-28.625	154.10000	87	103	female	2	3	0.18	3
576	06-Jan-01	-28.625	154.10000	82	98	male	1	2		2
577	06-Jan-01	-28.625	154.10000	101	118	male	2	3	0.18	3
578	06-Jan-01	-28.625	154.10000	182	204	male	8	4	0.14	4
579	05-Jan-01	-28.283332	155.71665	137	156	female	3	2		2
580	05-Jan-01	-28.283332	155.71665	114	132	male	1	3	0.47	3
581	05-Jan-01	-28.283332	155.71665	75	90	female	1	3	0.39	3
582	05-Jan-01	-28.283332	155.71665	186	208	female	8	2	0.13	2
583	05-Jan-01	-28.283332	155.71665	182	204	male	7	3	0.22	3
584	05-Jan-01	-28.283332	155.71665	140	159	female		5		5
585	05-Jan-01	-28.283332	155.71665	138	157	female	4	4		4
586	05-Jan-01	-28.283332	155.71665	155	175	male	5	3	0.18	3
587	05-Jan-01	-28.283332	155.71665	116	134	female	4	3	0.2	3
588	07-Jan-01	-28.566667	154.11666	164	185	male	6	4	0.13	4
589	07-Jan-01	-28.566667	154.11666	161	182	male	5	4	0.38	4
590	07-Jan-01	-28.566667	154.11666	157	177	female	6	4	0.27	4
591	08-Jan-01	-29.399999	153.94999	116	134	female	2	2	0.53	2
592	08-Jan-01	-29.399999	153.94999	183	205	male	6	4	0.35	4

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
593	07-Jan-01	-28.566667	154.11666	174	196	female	6	3	0.46	3
594	06-Jan-01	-28.116666	155.75	154	174	male	8	3	0.09	3
595	07-Jan-01	-27.850000	154.58332	100	117	male	2	3	0.24	3
596	07-Jan-01	-27.850000	154.58332	142	161	female	5	2	0.17	2
597	07-Jan-01	-27.850000	154.58332	113	131	male	3	2	0.14	2
598	09-Jan-01	-27.850000	154.60000	76	91	female	1	1	0.32	1
599	09-Jan-01	-27.850000	154.60000	180	202	male	9	4	0.07	4
600	09-Jan-01	-27.850000	154.60000	133	152	female	4	4	0.67	4
601	06-Jan-01	-28.116666	155.75	176	198	female	8	3	0.08	3
602	09-Jan-01	-27.850000	154.60000	128	147	female	4	3	0.17	3
603	06-Jan-01	-28.116666	155.75	168	189	female	6	2	0.24	2
604	09-Jan-01	-27.850000	154.60000	137	156	male	5	1	0.25	1
605	09-Jan-01	-27.850000	154.60000	117	135	female	1	1	0.74	1
606	07-Jan-01	-27.850000	154.58332	73	88	female	1	3	0.21	3
607	09-Jan-01	-27.850000	154.60000	176	198	male	10	3	0.34	3
608	06-Jan-01	-28.116666	155.75	108	125	male	1	2		2
609	08-Jan-01	-27.600000	154.19999	144	164	female	7	3	0.61	3
610	06-Jan-01	-28.116666	155.75	120	138	female	3	3	0.29	3
611	08-Jan-01	-27.600000	154.19999	167	188	female	5	2	0.2	2
612	08-Jan-01	-27.600000	154.19999	104	121	female	2	2	0.4	2
613	08-Jan-01	-27.600000	154.19999	123	141	female	4	2	0.68	2
614	08-Jan-01	-27.600000	154.19999	141	160	female	5	4	0.09	4
615	08-Jan-01	-29.399999	153.94999	197	220	female	7	3	0.06	3
616	08-Jan-01	-27.600000	154.19999	208	232	female	8	3		3
617	08-Jan-01	-27.600000	154.19999	76	91	female	1	1	0.14	1
618	06-Jan-01	-28.116666	155.75	148	168	female	5	3	0.26	3
619	04-Mar-01	-26.641666	163.29165	165	186	female	6	2	0.1	2
620	04-Mar-01	-26.641666	163.29165	188	211	male	10	4	0.11	4
621	01-Mar-01	-27.808334	155.45834	191	214	male	8	3	0.27	3
622	28-Feb-01	-28.141666	155.68333	139	158	female	3	3	0.6	3
623	04-Mar-01	-26.641666	163.29165	199	222	female		5		5
624	04-Mar-01	-26.641666	163.29165	102	119	male	2	2	0.26	2
625	28-Feb-01	-28.141666	155.68333	67	82	male	0	3		3
626	06-Mar-01	-26.791666	163.05833	172	193	male	7	2	0.31	2
627	01-Mar-01	-27.808334	155.45834	136	155	female	4	3	0.27	3
628	28-Feb-01	-28.141666	155.68333	97	114	female	2	3	0.38	3
629	28-Feb-01	-28.141666	155.68333	160	181	female	7	3	0.4	3
630	04-Mar-01	-26.641666	163.29165	169	190	female	6	2	0.18	2
631	28-Feb-01	-28.141666	155.68333	180	202	male	7	3	0.15	3
632	28-Feb-01	-28.141666	155.68333	98	115	male	3	2	0.42	2
633	01-Mar-01	-27.808334	155.45834	143	163	male	3	4	0.26	4
634	04-Mar-01	-26.641666	163.29165	172	193	male	9	4	0.25	4
635	04-Mar-01	-26.641666	163.29165	134	153	female	2	2	0.19	2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
636	28-Feb-01	-28.141666	155.68333	172	193	male	6	3	0.2	3
637	28-Feb-01	-28.141666	155.68333	135	154	female	5	2	0.32	2
638	01-Mar-01	-27.808334	155.45834	110	127	female	3	2	0.35	2
639	01-Mar-01	-27.808334	155.45834	78	93	male	1	3	0.69	3
640	01-Mar-01	-27.808334	155.45834	210	234	female	9	3	0.12	3
641	06-Mar-01	-26.791666	163.05833	190	213	female	10	2	0.24	2
642	08-Mar-01	-26.908332	162.36666	139	158	female	7	3	0.19	3
643	08-Mar-01	-26.908332	162.36666	211	235	female	11	4	0.18	4
644	08-Mar-01	-26.908332	162.36666	123	141	female	6	3	0.28	3
645	09-Mar-01	-26.933334	162.41667	122	140	female	3	2	0.27	2
646	08-Mar-01	-26.908332	162.36666	138	157	female	4	3	0.18	3
647	08-Mar-01	-26.908332	162.36666	145	165	male	6	3	1.29	3
648	09-Mar-01	-26.933334	162.41667	122	140	female	3	2	0.25	2
649	08-Mar-01	-26.908332	162.36666	130	149	female	7	4	0.2	4
650	09-Mar-01	-26.933334	162.41667	215	239	female	12	4	0.24	4
651	09-Mar-01	-26.933334	162.41667	210	234	female	12	4		4
652	08-Mar-01	-26.908332	162.36666	165	186	male	5	3	0.39	3
653	09-Mar-01	-26.933334	162.41667	131	150	female	5	2	0.43	2
654	08-Mar-01	-26.908332	162.36666	134	153	male	5	3		3
655	07-Mar-01	-26.799999	162.80000	158	179	male	5	4	0.28	4
656	07-Mar-01	-26.799999	162.80000	137	156	male	5	4	0.2	4
657	05-Mar-01	-26.516666	163.67500	128	147	female	3	4	0.76	4
658	07-Mar-01	-26.799999	162.80000	118	136	female	3	3	0.47	3
659	07-Mar-01	-26.799999	162.80000	183	205	male	10	4	0.27	4
660	06-Mar-01	-26.791666	163.05833	160	181	male	6	3	0.28	3
661	07-Mar-01	-26.799999	162.80000	172	193	female	6	3	0.42	3
662	05-Mar-01	-26.516666	163.67500	150	170	female	7	4	0.63	4
663	05-Mar-01	-26.516666	163.67500	145	165	female	5	3	0.33	3
664	05-Mar-01	-26.516666	163.67500	90	106	male	1	1	0.49	1
665	06-Mar-01	-26.791666	163.05833	188	211	male	11	4	0.06	4
666	05-Mar-01	-26.516666	163.67500	129	148	male	3	2	0.4	2
667	06-Mar-01	-26.791666	163.05833	208	232	female	12	4	0.1	4
668	06-Mar-01	-26.791666	163.05833	130	149	female	5	4		4
669	06-Mar-01	-26.791666	163.05833	105	122	female	2	3		3
670	07-Mar-01	-26.799999	162.80000	202	225	female	10	3	0.2	3
671	07-Mar-01	-26.799999	162.80000	99	116	female	0	2		2
672	06-Mar-01	-26.791666	163.05833	170	191	male	5	3	0.17	3
673	05-Mar-01	-26.516666	163.67500	120	138	male	5	3	0.19	3
674	05-Mar-01	-26.516666	163.67500	137	156	female	8	3	0.23	3
675	07-Mar-01	-26.799999	162.80000	216	240	female	10	4	0.05	4
676	06-Mar-01	-26.791666	163.05833	187	209	male		5		5
677	08-Mar-01	-26.908332	162.36666	60	74		0	1		1
678	08-Mar-01	-26.908332	162.36666	59	73		0	1		1

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
679	05-Jan-01	-23.316667	154.55000	159	180	female	6	3	0.27	3
680	06-Jan-01	-23.291667	154.90832	146	166	male	7	2	0.28	2
681	06-Jan-01	-23.291667	154.90832	175	197	male	5	2	0.43	2
682	06-Jan-01	-23.291667	154.90832	174	196	male	9	4	0.25	4
683	08-Jan-01	-25.491666	154.96667	154	174	male	6	3	0.05	3
684	11-Jan-01	-25.416666	155.05000	139	158	female	4	2	0.59	2
685	08-Jan-01	-25.491666	154.96667	217	241	female	8	3	0.14	3
686	05-Feb-01	-26.433332	154.06666	154	174	female	10	3	0.15	3
688	22-Nov-99	-31.083333	161.16667	206	229.7	female	10	4	0.34	4
690	22-Nov-99	-31.083333	161.16667	171	192	female	8	2	0.04	2
691	22-Nov-99	-31.083333	161.16667	185	207	female	5	1	0.12	1
692	22-Nov-99	-31.083333	161.16667	129	148	male	5	3	0.37	3
693	22-Nov-99	-31.083333	161.16667	107	124	female	6	3	0.07	3
694	22-Nov-99	-31.083333	161.16667	122	140	female	4	4	0.26	4
696	26-Nov-99	-30.950000	161.25	96	112	male	2	3	0.17	3
697	23-Nov-99	-30.966667	161.39999	142	161	male	5	3	0.21	3
698	23-Nov-99	-30.966667	161.39999	183	205	female	6	3	0.11	3
699	23-Nov-99	-30.966667	161.39999	112	130	female	2	2	0.41	2
701	23-Nov-99	-30.966667	161.39999	189	212	female	8	3	0.19	3
702	23-Nov-99	-30.966667	161.39999	223	248	female	15	4	0.27	4
703	23-Nov-99	-30.966667	161.39999	137	156	female	4	2	0.32	2
704	23-Nov-99	-30.966667	161.39999	99	116	male	3	3	0.15	3
705	23-Nov-99	-30.966667	161.39999	120	138	female	3	3	0.04	3
706	24-Nov-99	-30.950000	161.39999	171	192	female	7	2	0.03	2
709	24-Nov-99	-30.950000	161.39999	166	187	male	8	2	0.16	2
710	24-Nov-99	-30.950000	161.39999	198	221	male	10	4	0.12	4
711	24-Nov-99	-30.950000	161.39999	180	202	male	9	3	0.1	3
712	24-Nov-99	-30.950000	161.39999	181	203	female	7	4	0.31	4
713	24-Nov-99	-30.950000	161.39999	161	182	female	7	4	0.25	4
714	24-Nov-99	-30.950000	161.39999	190	213	female	9	3	0.4	3
716	27-Nov-99	-31.066667	161.14999	167	188	female	8	2	0.12	2
717	27-Nov-99	-31.066667	161.14999	196	219	female	12	4	0.26	4
718	27-Nov-99	-31.066667	161.14999	234	260	female	15	4	0.29	4
719	27-Nov-99	-31.066667	161.14999	188	211	female	5	4	0.14	4
720	27-Nov-99	-31.066667	161.14999	101	118	female	3	2	0.32	2
721	27-Nov-99	-31.066667	161.14999	107	124	male	2	4	0.51	4
723	19-Jul-97	-26.799999	155.80000	171	188	female	11	4	0.1	4
724	14-Jul-97	-26.233333	155.21665	136	153	male	5	3	0.18	3
725	23-Jul-97	-26.966667	156.38333	104	117	female	5	4	0.22	4
726	21-Jul-97	-27.116666	156.41667	157	173	female	4	4	0.31	4
727	19-Jul-97	-26.799999	155.80000	104	120		3	3	0.21	3
728	14-Jul-97	-26.233333	155.21665	157	173	female	6	2	0.18	2
729	12-Jul-97	-25.933332	156.18333	108	123	male	3	2	0.39	2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
730	20-Jul-97	-27.566667	156.03334	166	184	male	10	3	0.24	3
731	13-Jul-97	-26.166666	155.31666	102	117	female	3	3	0.21	3
734	04-Aug-97	-32	155	191	206	female	9	4	0.23	4
736	13-Jul-97	-26.166666	155.31666	185	201	female	8	3	0.19	3
737	19-Aug-97	-28.5	156	212	238	female	9	3	0.27	3
738	19-Jun-97	-32.75	112.5	171	191	female	6	4	0.28	4
739	18-Jun-97	-32.849998	112.71666	175	195	male	8	4	0.21	4
740	08-Aug-97	-28.850000	158.57499	174	196	female	6	3	0.23	3
742	20-Aug-97	-25.549999	156.14999	172	191	male				
743	19-Aug-97	-28.5	156	108	126		3	1	0.1800	1
744	16-Jun-97	-32.299999	112.63333	188	210	female	12	4	0.24	4
745	21-Aug-97	-25.666666	155.80000	176	199		8	3		3
746	21-Aug-97	-25.666666	155.80000	124	141		2	3	0.47	3
748	19-Jun-97	-32.75	112.5	169	179	male	5	3	0.24	3
749	19-Jul-97	-24.516666	155.38333	110	128		1	2	1.3	2
750	20-Jul-97	-24.108333	154.91665	145	163		6	3	0.1200	3
751	20-Jul-97	-24.108333	154.91665	137	157		3	2	0.6899	2
752	18-Jun-97	-32.849998	112.71666	165	184	female	6	3	0.3	3
753	19-Jun-97	-32.75	112.5	175	197	male	6	3	0.21	3
755	11-Jun-97	-32.400001	113.13333	162	179		7	3	0.1000	3
756	23-Sep-99	-13	98	150	168	female	4	3	0.5	3
757	19-Jul-97	-24.516666	155.38333	161	184		7	3	0.29	3
758	28-Jul-97	-32.950000	155.38333	149	166		5	3		3
759	20-Jul-97	-24.108333	154.91665	129	148	female	4	3	0.15	3
760	19-Jun-97	-32.75	112.5	163	182	female	6	2	0.15	2
761	22-Jul-97	-24.100000	156.10000	147	169	female	5	3	0.47	3
762	21-Aug-97	-25.666666	155.80000	142	165	male	6	3	0.15	3
763	17-Jul-97						7	3		3
767	20-Aug-97	-25.549999	156.14999	207	230		11	3		3
769	22-Jul-97	-31	155.33332	164	180	female	8	2	0.21	2
770	01-Jul-97	-33.583332	112.66666	157	176	male	6	2	0.17	2
771	23-Jul-97	-32.25	155.25	141	158	female	3	1	0.52	1
772	30-Jun-97	-33.183334	113.88333	123	139	female	5	4	0.29	4
774	24-Jul-97	-30	155	167	188	female	7	4	0.24	4
778	22-Jul-97	-31	155.33332	200	220	male	8	2	0.13	2
779	07-Aug-97	-28.633333	160.36666	202	227	male	9	4	0.17	4
782	16-Aug-97	-28.366666	160.26666	163	180	male	9	4		4
784	13-Aug-97	-28.233333	158.73333	172	196	female	9	3	0.14	3
785	19-Jul-97	-26.799999	155.80000	157	175	female	7	4	0.18	4
786	26-Aug-97	-28.649999	159.64999	185	207	female	8	4	0.24	4
788	24-Aug-97	-29.75	159.44999	177	196	male	10	4	0.12	4
789	03-Jul-97	-32.950000	113.76667	202	223	female	11	3	0.12	3
791	30-Aug-97	-30.700000	160.43333	131	151	female	5	4	0.22	4

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
792	26-Aug-97	-29.033332	161.25	190	214					
793	22-Aug-97	-29.633333	160.76666	170	187					
794	23-Aug-97	-28.983333	160.36666	156	173	female	8	2	0.29	2
795	23-Aug-97	-28.983333	160.36666	165	183	female	6	4		4
796	24-Jul-97	-30	155	166	190	female	7	4	0.18	4
797	20-Jul-97	-27.566667	156.03334	178	193	male	9	2	0.24	2
799	23-Jul-97	-26.966667	156.38333	171	191	female	9	2	0.06	2
800	20-Jul-97	-27.566667	156.03334	190	210	female	8	3	0.42	3
801	29-Jul-97	-32.133335	154.73333	176	195	male	7	3	0.16	3
802	23-Jul-97	-26.966667	156.38333	114	130	female	3	2	0.43	2
803	21-Jul-97	-27.116666	156.41667	144	160	male	5	4	0.24	4
805	22-Jul-97	-27.566667	155.03334	139	157	male	4	2	0.53	2
806	29-Jul-97	-32.133335	154.73333	156	176	female	6	2	0.17	2
810	16-Jul-97	-27.066667	155.19166	153	168	female	6	2	0.03	2
811	16-Jul-97	-27.066667	155.19166	186	209	female	8	2	0.2	2
812	23-Jul-97	-26.966667	156.38333	157	174	female	5	4	0.13	4
817	12-Jul-01	-35.175003	151.41665	72	87		1	2	0.42	2
818	13-Jul-01	-35.066665	151.58332	172	193	female	5	2	0.39	2
819	13-Jul-01	-35.066665	151.58332	74	89		0	1		1
820	13-Jul-01	-35.066665	151.58332	150	170	female	6	4	0.2	4
821	14-Jul-01	-35.700000	151.78334	73	88	male	1	2	0.23	2
822	14-Jul-01	-35.700000	151.78334	165	186	female	5	3		3
823	14-Jul-01	-35.700000	151.78334	78	93	male	1	4	0.09	4
824	14-Jul-01	-35.700000	151.78334	91	107	female	2	1	0.37	1
825	14-Jul-01	-35.700000	151.78334	73	88	female	1	4	0.17	4
826	14-Jul-01	-35.700000	151.78334	174	196	female	8	3	0.33	3
827	14-Jul-01	-35.416667	151.58332	74	88	male	1	4	0.37	4
828	14-Jul-01	-35.416667	151.58332	78	92	female	1	3	0.33	3
842	10-Aug-01	-33.049999	152.5	79	94	female	1	4	0.26	4
843	10-Aug-01	-33.049999	152.5	137	156	female		5		5
844	10-Aug-01	-33.049999	152.5	162	183	female	6	3	0.08	3
845	10-Aug-01	-33.049999	152.5	94	110	male	1	3	0.42	3
846	10-Aug-01	-33.049999	152.5			female	5	3	0.5799	3
847	10-Aug-01	-33.049999	152.5	146	166	female	7	3	0.04	3
848	10-Aug-01	-33.049999	152.5	122	140	female	7	3	0.04	3
849	11-Aug-01	-32.733333	153.13333	131	150	female	5	4	0.3	4
850	11-Aug-01	-32.733333	153.13333	145	165	male	6	2	0.45	2
851	11-Aug-01	-32.733333	153.13333	135	154	male	3	3	0.4	3
852	11-Aug-01	-32.733333	153.13333	151	171	male	10	3	0.1	3
853	04-Aug-01	-33.275001	152.68333	175	197	male	10	3	0.12	3
854	04-Aug-01	-33.275001	152.68333	152	172	male	8	3	0.03	3
855	04-Aug-01	-33.275001	152.68333	82	98	male	3	3	0.34	3
856	04-Aug-01	-33.275001	152.68333	185	207	female	7	3	0.44	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
857	04-Aug-01	-33.275001	152.68333	74	89	female	1	2	0.12	2
858	07-Aug-01	-33.083335	152.50833	160	181	female	9	4	0.03	4
859	07-Aug-01	-33.083335	152.50833	80	95	male	2	2	0.06	2
860	08-Aug-01	-33.75	152.48333	131	150	female	4	1	0.1	1
862	08-Aug-01	-33.75	152.48333	169	190	female	7	3	0.04	3
863	08-Aug-01	-33.75	152.48333	185	207	female	12	3	0.1	3
864	03-Aug-01	-33.466667	152.53334	177	199	female	6	3	0.42	3
865	08-Aug-01	-33.099998	152.81666	184	206	female	5	4	0.4	4
866	08-Aug-01	-33.099998	152.81666	129	148	male	4	2	0.44	2
867	05-Aug-01	-37.516666	151.06666	76	91	male	0	2		2
868	05-Aug-01	-37.516666	151.06666	76	91	male	1	3		3
869	05-Aug-01	-37.516666	151.06666	77	92	male	1	1	0.27	1
870	08-Jan-01	-29.399999	153.94999	242	268	female	14	4	0.27	4
871	08-Jan-01	-29.399999	153.94999	189	212	female	9	2	0.15	2
872	08-Jan-01	-29.399999	153.94999	173	195	male	8	3		3
873	16-Dec-99	-28.558332	158.25833	177	199	female	7	3	0.35	3
875	17-Feb-95	-16	118	132	151	male	6	3	0.13	3
876	03-Jul-95	-30.333333	154.80000	127	146	female		5		5
877	02-Jul-95	-27.799999	154.80000	145	164	female	4	2	0.36	2
879	03-Jul-95	-30.333333	154.80000	165	187	female	5	2	0.12	2
883	27-Feb-95	-17	118	78	94	female	3	2	0.07	2
885	20-Feb-95	-16	118	76	88	male	2	3	0.31	3
887	13-Feb-95	-16	119	86	98	male	1	2	0.45	2
888	17-Feb-95	-16	118	137	159	male	8	3	0.26	3
889	18-Feb-95	-16	118	126	144	male		5		5
891	17-Feb-95	-16	118	76	89	male	3	2	0.21	2
892	19-Feb-95	-16	118	88	101	female	2	2	0.06	2
894	25-Feb-95	-16	118	87	102	male	3	1	0.05	1
895	21-Feb-95	-16	118	67	83	female	1	1	0.1	1
896	12-Feb-95	-17	118	82	97	male	1	2	0.48	2
897	20-Feb-95	-16	118	122	140	male	4	1	0.3	1
899	16-Feb-95	-16	119	82	99	female	3	4	0.11	4
902	16-Feb-95	-16	119	160	183	female		5		5
903	15-Feb-95	-16	119	164	185	male	6	4	0.16	4
905	27-Feb-95	-17	118	133	150	male	4	4	0.32	4
906	02-Jul-95	-27.799999	154.80000	125	143	female	3	3	0.55	3
907	17-Feb-95	-16	118	131	148			4		4
908	14-Feb-95	-16	119	119	135	male	4	2	0.29	2
909	17-Feb-95	-16	118	144	164					
910	14-Feb-95	-16	119	164	185	female	7	2	0.15	2
911	19-Feb-95	-16	118	112	127	male	5	2	0.26	2
912	22-Feb-95	-16	118	141	162	female	3	4	0.35	4
913	17-Feb-95	-16	118	126	144	male	5	3	0.17	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
914	03-Jul-95	-30.333333	154.80000	176	198	female	6	3	0.28	3
915	02-Jul-95	-27.799999	154.80000	122	140	female	4	4	0.53	4
916	03-Jul-95	-30.333333	154.80000	191	213	female		5		5
917	03-Jul-95	-30.333333	154.80000	114	132	female	4	3	0.1	3
918	15-Feb-95	-16	119	108	125	male	6	3	0.42	3
919	19-Feb-95	-16	118	214	239	female	11	2	0.26	2
920	17-Feb-95	-16	118	210	234			4		4
921	17-Feb-95	-16	118	150	168	male	6	3	0.2	3
922	03-Jul-95	-30.333333	154.80000	115	129	female		5		5
923	19-Feb-95	-16	118	136	157	male	6	3	0.13	3
925	12-Feb-95	-17	118	89	105	male	2	2	0.23	2
926	20-Feb-95	-16	118	142	162	male	7	4	0.28	4
927	18-Jul-97	-27.383333	156		222	female	8	4	0.51	4
928	14-Jul-97	-26.850000	156.36666		186	female	4	4	0.68	4
929	27-Jul-97	-28.549999	156.38333		219	female	10	2	0.42	2
930	23-Jul-97	-27.766666	156.69999		139	female	4	1	0.34	1
931	18-Jul-97	-27.383333	156		178	female	6	3	0.31	3
932	15-Jul-97	-27.149999	156.44999		181	female	6	3	0.95	3
933	23-Jul-97	-27.766666	156.69999		229	female	9	4	0.66	4
934	23-Jul-97	-27.766666	156.69999		189	female		5		5
935	22-Jul-97	-27.516666	156.06666		203	female		5		5
936	20-Jul-97	-27.383333	156.28334		179	female	6	3	0.38	3
937	23-Jul-97	-27.766666	156.69999		168	female	6	2	0.25	2
938	14-Jun-97	-32.299999	112.48332	115	134	male	6	3	0.13	3
939	12-Jun-97	-32.150001	112.86666			female		4		4
940	15-Jun-97	-31.866666	112.33333	200	221	female	9	3	0.25	3
941	16-Jun-97	-32.299999	112.63333	176	193	male	8	2	0.38	2
942	15-Jun-97	-31.866666	112.33333	180	202	female	9	4	0.21	4
943	15-Jun-97	-31.866666	112.33333	165	187	female	8	3	0.08	3
944	14-Jun-97	-32.299999	112.48332	173	191	male	9	3	0.11	3
945	14-Jun-97	-32.299999	112.48332			female				
946	06-Aug-97	-28.916666	161		132	female	5	4	0.56	4
947	31-Jul-97	-28.799999	160.68333		156	female	5	2	0.82	2
948	03-Aug-97	-29.033332	161.08332		162	female		5		5
949	30-Jul-97	-30.600000	157.73333		233	female		5		5
950	02-Aug-97	-29.033332	161.13333		226	female	8	2	0.38	2
951	21-Jul-97	-30.75	155.25	130	154	female	6	2	0.2	2
952	30-Jul-97	-32.766666	154.76666	184	218	male	10	3	0.29	3
953	29-Jul-97	-32.066665	154.71665	104	127	male	3	2	0.07	2
954	01-Aug-97	-32.566665	154.66667	132	150	male	6	4	0.09	4
955	01-Aug-97	-32.566665	154.66667	108	123	female	4	3	0.12	3
956	09-Aug-97	-28.616666	159.98333		175	female	5	3	0.39	3
957	11-Aug-97	-28.450000	159.33332	161	180	male	7	4	0.07	4

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
958	08-Aug-97	-28.850000	158.57499	138	160	male		5		5
959	08-Aug-97	-28.850000	158.57499	183	207	female	9	3	0.52	3
960	11-Aug-97	-28.450000	159.33332	170	192	male	8	4	0.18	4
961	06-Jul-97	-30.783332	110.98332	189	206	male	10	3	0.06	3
962	13-Aug-97	-27	156.90832		184	female		5		5
963	13-Aug-97	-27	156.90832		140	female	3	4	0.09	4
964	13-Aug-97	-27	156.90832		147	female	3	4	0.34	4
965	13-Aug-97	-27	156.90832		168	female		5		5
966	12-Aug-97	-28.700000	157.71665		116	female	2	2		2
967	06-Aug-97	-28.916666	161		132	female		5		5
968	09-Aug-97	-28.616666	159.98333		175	female		5		5
969	11-Aug-97	-28.600000	156.83332		190	female		5		5
970	17-Aug-97	-23.200000	154.66667		113	female	4	4	0.1	4
971	11-Aug-97	-28.600000	156.83332		187			4		4
975	23-Oct-01	-27	157.75	180	202	female	13	4	0.27	4
976	26-Oct-01	-27.524999	157.41665	215	239	female	15	4	0.38	4
977	21-Oct-01	-27	157.53334	150	170	female		5		5
978	24-Oct-01	-26.416666	157.5	180	202	female	7	4		4
979	16-Oct-01	-27	157.5	160	181	female	9	4	0.2	4
980	28-Oct-01	-27.166667	157.58334	170	191	female	11	2	0.19	2
981	28-Oct-01	-27.166667	157.58334			male	7	2	0.1	2
982	22-Oct-01	-27	157.41665	150	170	female	8	4	0.27	4
983	01-Oct-01	-27.5	157.32499	175	197			4		4
984	22-Oct-01	-27	157.41665	130	149	female	5	3	0.19	3
985	26-Oct-01	-27.524999	157.41665	155	175	female	6	4	0.82	4
986	26-Oct-01	-27.524999	157.41665	135	154	male	6	3	0.27	3
987	22-Oct-01	-27	157.41665	160	181	female	10	4	0.14	4
988	17-Oct-01	-27	157.56666	190	213	female	10	4	0.35	4
989	25-Oct-01	-26.375	157.5	145	165	female		5		5
990	28-Oct-01	-27.166667	157.58334	150	170	female	5	3	0.13	3
991	23-Oct-01	-27	157.75	175	197	female	11	3	0.13	3
992	22-Oct-01	-27	157.41665	140	159	female		5		5
993	25-Oct-01	-26.375	157.5	155	175	female	6	4	0.71	4
994	28-Oct-01	-27.166667	157.58334			female		4		4
995	28-Oct-01	-27.166667	157.58334	170	191	female	11	4	0.09	4
996	29-Oct-01	-28.533332	158.48333	201	224	female	14	4	0.04	4
997	29-Oct-01	-28.533332	158.48333	208	232	female	9	3	0.04	3
998	11-Oct-01	-28.450000	154.94999	158	179	female		5	0.12	5
999	01-Oct-01	-27.5	157.32499	201	224	female	9	3	0.07	3
1000	29-Sep-01	-28.775001	158.05833	225	250	female		5	0.12	5
1001	28-Sep-01	-29.716667	157.94999	188	211	female	8	2	0.29	2
1002	29-Oct-01	-28.533332	158.48333	134	153	female	5	3	0.36	3
1003	29-Sep-01	-28.775001	158.05833	195	218	male	9	3	0.13	3

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1004	29-Oct-01	-28.533332	158.48333	145	165	male	5	3	0.14	3
1005	01-Oct-01	-27.5	157.32499	205	229	female	11	2	0.06	2
1006	29-Sep-01	-28.775001	158.05833	210	234	female	13	4	0.17	4
1007	29-Oct-01	-28.533332	158.48333	170	191	female	7	3	0.34	3
1008	30-Sep-01	-29.450000	158.03334	185	207	female	10	4	0.06	4
1009	28-Oct-01	-27.166667	157.58334	155	175	female	8	4	0.07	4
1010	31-Oct-01	-28.716667	158.35000	145	165	female	5	4	0.65	4
1011	31-Oct-01	-28.716667	158.35000	143	163	female	8	4	0.07	4
1012	31-Oct-01	-28.716667	158.35000	168	189		9	3	0.16	3
1013	31-Oct-01	-28.716667	158.35000	196	219	female	11	3	0.19	3
1014	31-Oct-01	-28.716667	158.35000	135	154	male	5	3	0.11	3
1015	31-Oct-01	-28.716667	158.35000	175	197	female	9	4		4
1016	31-Oct-01	-28.716667	158.35000	185	207	female	12	4	0.32	4
1017	31-Oct-01	-28.716667	158.35000	173	195	female	8	2	0.08	2
1018	28-Oct-01	-27.166667	157.58334	197	220	female	8	3	0.09	3
1019	29-Oct-01	-28.533332	158.48333	185	207	female	8	2	0.35	2
1020	29-Oct-01	-28.533332	158.48333	150	170	female	8	3	0.13	3
1021	28-Oct-01	-27.166667	157.58334	145	165	female	5	4	0.43	4
1022	28-Oct-01	-27.166667	157.58334	155	175	female	6	3	0.2	3
1023	26-Oct-01	-27.524999	157.41665	150	170	male	6	3	0.26	3
1024	01-Oct-01	-27.5	157.32499	147	167	female	5	3	0.34	3
1025	06-Oct-01	-27.116666	157.16667	150	170	female	5	4	0.37	4
1026	01-Oct-01	-27.5	157.32499	135	154	female	5	4	0.13	4
1027	04-Oct-01	-26.333333	157.05000	145	165	female	5	3	0.2	3
1028	30-Nov-01	-36.166667	152.53332	230		female	10	4	0.17	4
1029	30-Nov-01	-36.166667	152.53332	183		female	9	3		3
1030	30-Nov-01	-36.166667	152.53332	85		female	1	1	0.27	1
1031	23-Nov-01	-25	156.625	145		female	6	4	0.12	4
1032	23-Nov-01	-25	156.625	110		female	3	2	0.33	2
1033	27-Nov-01	-24.5	156	240		female	15	2	0.14	2
1034	23-Nov-01	-25	156.625	180		female		5		5
1035	23-Nov-01	-25	156.625	180		female	10	4	0.24	4
1036	25-Nov-01	-25	156.625	170		female	7	3	0.47	3
1037	24-Nov-01	-25	156.73333	175		female	9	2	0.38	2
1038	22-Nov-01	-25	157	165		female	9	2	0.08	2
1039	27-Nov-01	-24.5	156	240		female	10	4	0.14	4
1040	25-Nov-01	-25	156.625	180		female	7	3	0.26	3
1041	25-Nov-01	-25	156.625	170		female	7	2	0.2	2
1042	05-Dec-01	-27.375	157.38333	97		female	3	4	0.13	4
1043	05-Dec-01	-27.375	157.38333	150		female	3	4	0.68	4
1044	26-Nov-01	-27.183333	156.63333	95		female	2	4		4
1045	27-Nov-01	-27.15	156.51666	87		female	2	4		4
1046	26-Nov-01	-27.183333	156.63333	127		male	5	3	0.42	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1047	27-Nov-01	-27.15	156.51666	146		female		5		5
1048	27-Nov-01	-27.15	156.51666	153		female	7	2	0.25	2
1049	23-Nov-01	-27.883333	160.86666	190		female	8	2	0.43	2
1050	23-Nov-01	-27.883333	160.86666	190						
1051	24-Nov-01	-27.516666	160.4	155		female	5	2	0.43	2
1052	23-Nov-01	-27.883333	160.86666	200		female	8	3	0.52	3
1053	23-Nov-01	-27.883333	160.86666	134		female	4	3	0.29	3
1054	24-Nov-01	-27.516666	160.4	130		female	6	4	0.19	4
1055	24-Nov-01	-28.041667	161.125	170		female	6	4	0.24	4
1056	23-Nov-01	27.883333	160.6	165		female	9	2	0.25	2
1057	28-Nov-01	-27.533332	161.58334	176		female	9	3	0.26	3
1058	27-Nov-01	-27.549999	161.64166	202		female	15	4	0.11	4
1059	26-Nov-01	-27.541667	161.55833	130		female	6	2	0.25	2
1060	26-Nov-01	-27.541667	161.55833	175		female	5	3	0.37	3
1061	06-Dec-01	-25.683332	157.11666	203		female	12	3	0.13	3
1062	27-Nov-01	-27.549999	161.64166	205		female		5	0.13	5
1063	24-Nov-01	-28.041667	161.125	153			6	3		3
1064	27-Nov-01	-27.549999	161.64166	258		female	16	4		4
1065	28-Nov-01	-27.533332	161.58334	176		male	8	2	0.11	2
1066	26-Nov-01	-27.541667	161.55833	180		female	8	3	0.23	3
1067	28-Nov-01	-27.533332	161.58334	197		female	11	4	0.11	4
1068	26-Nov-01	-27.541667	161.55833	220		female	11	3	0.15	3
1069	27-Nov-01	-24.5	156	200		female	10	3	0.18	3
1070	26-Nov-01	-25	156.75	90		female	4	2	0.38	2
1071	26-Nov-01	-27.183333	156.63333	143		male	5	3	0.18	3
1072	26-Nov-01	-27.183333	156.63333	151		male	5	4		4
1073	24-Nov-01	-27.516666	160.4	163		female	7	4	0.4	4
1074	26-Nov-01	-27.183333	156.63333			female	4	3	0.36	3
1076	23-Nov-01	-27.883333	160.86666	140		female	3	2	0.43	2
1077	24-Nov-01	-27.516666	160.4	148		female	6	2	0.21	2
1078	23-Nov-01	-27.883333	160.86666	152		male	5	4	0.4	4
1079	23-Nov-01	-27.883333	160.86666	149		female	6	4	0.21	4
1080	23-Nov-01	-27.883333	160.86666	133		male	4	4	0.37	4
1081	23-Nov-01	-27.883333	160.86666	203		female	14	4	0.09	4
1082	23-Nov-01	-27.883333	160.86666	226		female	8	3	0.18	3
1083	23-Nov-01	-27.883333	160.86666	204		female	10	3	0.11	3
1084	24-Nov-01	-27.516666	160.4	234		female	16	2	0.23	2
1085	24-Nov-01	-27.516666	160.4	134						
1086	24-Nov-01	-27.516666	160.4	178		male	10	4	0.06	4
1087	23-Nov-01	-27.883333	160.86666	190		female	8	3	0.17	3
1088	24-Nov-01	-27.516666	160.4	166		female	7	2	0.16	2
1089	05-Dec-01	-27.375	157.38333	76		male	1	2	0.17	2
1090	04-Dec-01			230		female	15	4	0.28	4

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1091	15-Dec-01	-24.166666	153.9	145		female	5	4	0.58	4
1092	15-Dec-01	-24.166666	153.9	219		female	10	3	0.42	3
1093	20-Dec-01	-23.916666	153.56666	139		female	5	1	0.38	1
1094	21-Dec-01	-24.016666	153.55	200		female	8	2	0.48	2
1095	21-Dec-01	-24.016666	153.55	138		male	6	3	0.14	3
1096	21-Dec-01	-24.016666	153.55	125		male	4	2	0.41	2
1097	21-Dec-01	-24.016666	153.55	170		male	8	4	0.31	4
1098	30-Dec-01	28.833333	153.26666	131		male	4	4	0.46	4
1099	30-Dec-01	28.833333	153.26666	104		female	3	3	0.06	3
1100	01-Dec-01			215		female	11	3	0.25	3
1101	01-Dec-01			170		female	7	3	0.5	3
1102	01-Dec-01			190		female		5		5
1103	02-Dec-01			170		female	9	3	0.2	3
1104	02-Dec-01			130		male	5	3	0.26	3
1105	02-Dec-01			125		male	5	2	0.22	2
1106	02-Jan-02	-25	156	130		male		5		5
1107	01-Jan-02			185		male	5	3	0.54	3
1108	02-Jan-02	-25	156	130		male	3	2	0.26	2
1109	01-Jan-02			162		female	9	3	0.27	3
1110	01-Jan-02			132		male	5	3	0.39	3
1111	02-Jan-02	-25	156	190		female	8	4	0.24	4
1112	02-Jan-02	-25	156	100		female	3	3	0.42	3
1113	02-Jan-02	-25	156	50		female	1	2	0.13	2
1114	02-Jan-02	-25	156	140		female	9	4	0.15	4
1115	01-Jan-02			125		female	4	3	0.28	3
1116	01-Jan-02			148		male	6	3	0.31	3
1117	02-Jan-02	-25	156	165		male	9	3		3
1118	02-Jan-02	-25	156	140		female	4	3	0.13	3
1119	02-Jan-02	-25	156	130		female	6	3	0.35	3
1120	01-Jan-02			126		male	3	3	0.13	3
1121	01-Jan-02			150		male	6	3	0.11	3
1122	02-Jan-02	-25	156	120		female	3	2	0.9	2
1123	02-Jan-02	-25	156	160		female	7	4	0.29	4
1124	02-Jan-02	-23.566666	156.71666	185		female	9	3	0.12	3
1125	02-Jan-02	-23.566666	156.71666	126		male	4	2	0.14	2
1126	02-Jan-02	-23.566666	156.71666	144		female	8	3	0.13	3
1127	03-Jan-02	-25.25	157.05	150		female	7	3	0.19	3
1128	03-Jan-02	-25.25	157.05	220		female	14	3	0.26	3
1129	03-Jan-02	-25.25	157.05	201		female	9	4	0.14	4
1130	03-Jan-02	-25.25	157.05	238		female	12	3	0.32	3
1131	04-Jan-02	-25.183333	157	156		female	5	2	0.37	2
1132	04-Jan-02	-25.183333	157	175		female	7	3	0.24	3
1134	04-Jan-02	-25.183333	157	195		male	11	3	0.18	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1135	27-Nov-01	-27.549999	161.64166	143		female	8	3	0.25	3
1136	22-Jan-02	-28.45	161.5	115		female	3	2	0.29	2
1137	22-Jan-02	-28.45	161.5	139		female	5	4	0.24	4
1138	22-Jan-02	-28.45	161.5	186		female	8	3	0.14	3
1139	22-Jan-02	-28.45	161.5	184		male	8	3		3
1140	22-Jan-02	-28.45	161.5	146		female	4	3	0.48	3
1141	22-Jan-02	-28.45	161.5	183		male	9	3	0.29	3
1142	25-Jan-02	-28.5	161	140		female	6	4	0.23	4
1143	23-Jan-02	-28.5	161	186		female	9	3	0.17	3
1144	25-Jan-02	-28.5	161	163		female	7	3	0.12	3
1145	23-Jan-02	-28.5	161	148		male	5	3	0.2	3
1146	25-Jan-02	-28.5	161	87		female	2	3	0.17	3
1147	25-Jan-02	-28.5	161	123		female	4	2	0.09	2
1148	25-Jan-02	-28.5	161	111		female	4	3	0.23	3
1149	24-Jan-02	-28.5	161	199		female	8	4	0.3	4
1150	25-Jan-02	-28.5	161	131		female		5		5
1151	24-Jan-02	-28.5	161	150		female	6	4	0.33	4
1152	26-Jan-02	-28.416666	161	132		female	4	4	0.6	4
1153	24-Jan-02	-28.5	161	181		male	9	3	0.22	3
1154	26-Jan-02	-28.416666	161	140		male	5	3	0.29	3
1155	24-Jan-02	-28.5	161	162		female	7	3	0.35	3
1156	26-Jan-02	-28.416666	161	111		female	2	2	0.13	2
1157	24-Jan-02	-28.5	161	150		female	7	4	0.28	4
1158	26-Jan-02	-28.416666	161	167		female	8	2	0.18	2
1159	24-Jan-02	-28.5	161	141		male	6	2	0.07	2
1160	26-Jan-02	-28.416666	161	255		female	16	3		3
1161	24-Jan-02	-28.5	161	130		female	5	2	0.32	2
1162	26-Jan-02	-28.416666	161	200		female	10	2	0.17	2
1163	24-Jan-02	-28.5	161	162		male		5		5
1164	27-Jan-02	-28.5	161	211		male	12	4		4
1165	22-Jan-02	-28.45	161.5	134		male	5	3	0.18	3
1166	24-Jan-02	-28.5	161	200		male	10	4		4
1167	27-Jan-02	-28.5	161	150		female	6	4	0.2	4
1168	24-Jan-02	-28.5	161	191		male		5		5
1169	24-Jan-02	-28.5	161	163		female	7	4	0.07	4
1170	24-Jan-02	-28.5	161	177		male	8	2	0.26	2
1171	25-Jan-02	-28.5	161	130		female	2	2	0.67	2
1172	25-Jan-02	-28.5	161	155		female	8	3	0.12	3
1173	25-Jan-02	-28.5	161	181		male	7	3	0.24	3
1174	25-Jan-02	-28.5	161	160		male	10	3	0.16	3
1175	25-Jan-02	-28.5	161	161		female	7	3	0.2	3
1176	01-Feb-02	-23.733333	154.56666	162		female	8	2		2
1177	03-Feb-02	-23.683333	154.5	116		male	5	2	0.27	2

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1178	03-Feb-02	-23.683333	154.5	120		male	5	2	0.14	2
1179	04-Feb-02	-23.533333	155.83333	216		female	10	3	0.2	3
1180	05-Feb-02	-23.366666	156.05	210		female	10	3	0.22	3
1181	05-Feb-02	-23.366666	156.05	120		female	3	2	0.39	2
1182	07-Feb-02	27.016666	156.93333	174		female	10	4	0.22	4
1183	07-Feb-02	27.016666	156.93333	148		female	7	3	0.3	3
1184	07-Feb-02	27.016666	156.93333	127		female	5	3		3
1185	08-Feb-02	-27.4	156.95	178		male		5		5
1186	08-Feb-02	-27.4	156.95	195		male	8	4	0.37	4
1187	09-Feb-02	-27.216666	156.25	124		female	3	2	0.57	2
1188	09-Feb-02	-27.216666	156.25	179		female	9	3	0.21	3
1189	02-Feb-02	-29.366666	160.01666	220		female	11	2	0.17	2
1190	31-Jan-02	-26.333333	160.16666	172		female	7	2	0.2	2
1191	03-Feb-02	-29.416666	160.5	220		female	12	4	0.13	4
1192	03-Feb-02	-29.416666	160.5	188		female	8	3	0.25	3
1193	31-Jan-02	-26.333333	160.16666	189		male	8	4		4
1194	02-Dec-01			180		female	9	2	0.17	2
1195	19-Jan-02	-29.666666	156.5	198		female		5		5
1196	19-Jan-02	-29.666666	156.5	154		male	5	3	0.21	3
1197	19-Jan-02	-29.666666	156.5	84		female	1	3		3
1198	20-Jan-02	-29.666666	156.5	152		female	8	3		3
1199	20-Jan-02	-29.666666	156.5	182		female	8	4	0.19	4
1200	20-Jan-02	-29.666666	156.5	164		female	5	2	0.34	2
1201	20-Jan-02	-29.666666	156.5	100		male	4	2	0.23	2
1202	22-Jan-02	-28.266666	161.83333	172		male	7	3	0.27	3
1203	22-Jan-02	-28.266666	161.83333	152		female	6	3	0.05	3
1204	22-Jan-02	-28.266666	161.83333	132		male	6	3	0.24	3
1205	22-Jan-02	-28.266666	161.83333	190		female	9	2	0.2	2
1206	22-Jan-02	-28.266666	161.83333	171		male	7	3	0.22	3
1207	22-Jan-02	-28.266666	161.83333	139		female	3	3	0.6	3
1208	22-Jan-02	-28.266666	161.83333	172		male	8	3	0.16	3
1209	22-Jan-02	-28.266666	161.83333	120		male	4	4	0.11	4
1210	22-Jan-02	-28.266666	161.83333	150		male	5	2	0.4	2
1211	22-Jan-02	-28.266666	161.83333	210		female	11	3	0.22	3
1212	22-Jan-02	-28.266666	161.83333	173		male	8	3	0.16	3
1213	22-Jan-02	-28.266666	161.83333	140		male	7	3	0.2	3
1214	23-Jan-02	-28.266666	161.66666	128		female	3	2	0.99	2
1215	23-Jan-02	-28.266666	161.66666	215		female	9	3	0.32	3
1216	23-Jan-02	-28.266666	161.66666	172		female	6	4	0.19	4
1217	23-Jan-02	-28.266666	161.66666	186		female	8	3	0.12	3
1218	23-Jan-02	-28.266666	161.66666	171		female	10	4	0.14	4
1219	23-Jan-02	-28.266666	161.66666	167		female	6	3	0.45	3
1220	23-Jan-02	-28.266666	161.66666	170		female	8	3	0.27	3

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1221	23-Jan-02	-28.266666	161.66666	205		female	11	3	0.32	3
1222	20-Jan-02	-28.6	160.95	70		female	1	1		1
1223	20-Jan-02	-28.6	160.95	76		male	1	1		1
1224	22-Jan-02	-28.45	161.5	80		female	1	1	0.37	1
1225	23-Jan-02	-28.5	161	96		female	3	2	0.18	2
1226	20-Feb-02			166		female	7	3	0.32	3
1227	20-Feb-02			108		male	2	2	0.63	2
1228	22-Feb-02			218		female	9	3	0.23	3
1229	22-Feb-02			124		male	3	3		3
1230	22-Feb-02			124		female	5	4	0.28	4
1231	22-Feb-02			132		male	5	3	0.37	3
1232	22-Feb-02			145		male	5	2	0.14	2
1233	22-Feb-02			226		female	12	4		4
1234	23-Feb-02			240		female	14	4		4
1235	24-Feb-02			220		female	12	3	0.14	3
1236	04-Mar-02			232		female	13	4		4
1237	04-Mar-02			156		male	7	4	0.13	4
1238	02-May-02	-29	155.66666	160		female		5		5
1239	02-May-02	-29	155.66666	165		female	7	4	0.37	4
1240	02-May-02	-29	155.66666	130		female	2	2	0.42	2
1241	02-May-02	-29	155.66666	100		male	3	2	0.5	2
1242	02-May-02	-29	155.66666	195		female	9	3	0.21	3
1243	02-May-02	-29	155.66666	155		female	5	2	0.53	2
1244	02-May-02	-29	155.66666	165		female	6	3	0.36	3
1245	02-May-02	-29	155.66666	160		female	6	3	0.6	3
1246	02-May-02	-29	155.66666	210		female	9	2	0.1	2
1247	03-May-02	-28.833333	155.5	160		female	5	3	0.42	3
1248	03-May-02	-28.833333	155.5	125		male	5	4	0.32	4
1249	03-May-02	-28.833333	155.5	165		female		5		5
1250	03-May-02	-28.833333	155.5	150		female	7	4	0.3	4
1251	03-May-02	-28.833333	155.5	145		male	5	3	0.36	3
1252	24-May-02			135		female	4	3	0.32	3
1253	24-May-02			200		female	10	3	0.16	3
1254	24-May-02			150		female	4	3	0.22	3
1255	24-May-02			155		female	5	3	0.29	3
1256	24-May-02			145		female	6	4	0.5	4
1257	24-May-02			140		female	4	2	0.19	2
1258	24-May-02			120		female	3	2	0.28	2
1259	24-May-02			100		male	2	2	0.28	2
1260	27-May-02			175		female	10	4	0.62	4
1261	27-May-02			170		female	9	3	0.43	3
1262	27-May-02			160		male	11	3	0.21	3
1263	27-May-02			165		male	9	4	0.35	4

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1264	27-May-02			150		female	8	3	0.15	3
1265	27-May-02			135		male	7	3	0.39	3
1266	29-May-02			190		female	9	4	0.26	4
1267	29-May-02			160		female	5	3	0.42	3
1268	29-May-02			165		female	6	2	0.53	2
1269	29-May-02			145		female	5	3	0.35	3
1270	30-May-02			170		female		5		5
1271	30-May-02			145		female	6	3	0.62	3
1272	02-Mar-02	-30.133333	154.16666	228		female	13	4	0.26	4
1273	03-Mar-02	-30.216666	154.16666	183		female	7	4	0.37	4
1274	04-Apr-02	-28.683333	155.78333	187		female	8	3	0.42	3
1275	26-Apr-02	-23.533333	155.96666	227		male	10	4	0.41	4
1276	25-Apr-02	-23.8	156.01666	120		female		5		5
1277	24-Apr-02	-23.566666	156	225		female	15	4	0.24	4
1278	25-Apr-02	-23.8	156.01666	161		female	5	3	0.2	3
1279	25-Apr-02	-23.8	156.01666	92		female	2	2	0.26	2
1280	26-Apr-02	-23.533333	155.96666	155		female	7	3	0.36	3
1281	26-Apr-02	-23.533333	155.96666	93		male	2	2	0.61	2
1282	16-May-02	-23.366666	154.83333	136		female	4	2	0.42	2
1283	17-May-02	-23	154.75	170		female	6	2	0.32	2
1284	17-May-02	-23	154.75	114		female	4	3	0.59	3
1285	17-May-02	-23	154.75	94		male	2	2	0.31	2
1286	18-May-02	-22.6	154.65	129		female	4	3	0.38	3
1287	19-May-02	22.383333	154.53333	147		female	8	2	0.26	2
1288	20-May-02	-22.666666	154.41666	185		female	8	4	0.23	4
1289	25-May-02	-29.066666	157.06666	194		female	5	2	0.11	2
1290	25-May-02	-29.066666	157.06666	218		female	9	3	0.28	3
1291	26-Apr-02	-23.533333	155.96666	162		female	6	4	0.6	4
1292	26-May-02	-28.533333	157.63333	173		male	7	3	0.12	3
1293	27-May-02	-28.35	157.53333	171		female	5	2	0.33	2
1294	27-May-02	-28.35	157.53333	164		female	9	3	0.29	3
1295	27-Apr-02	-23.6	155.52	194		female	9	3	0.44	3
1296	27-May-02	-28.35	157.53333	164		female	9	2	0.56	2
1297	28-May-02	-28.9	157.18333	187		male		5		5
1298	28-May-02	-28.9	157.18333	156		male	6	3	0.26	3
1299	28-May-02	-28.9	157.18333	169		female	7	3	0.12	3
1300	28-May-02	-28.9	157.18333	152		female	4	4	0.68	4
1301	28-May-02	-28.9	157.18333	160		female	6	3	0.32	3
1302	29-May-02	-29.2	157.26666	96		male	2	3	0.13	3
1303	29-May-02	-29.2	157.26666	183		female	7	4	0.15	4
1304	29-May-02	-29.2	157.26666	162		male	5	1	0.3	1
1305	29-May-02	-29.2	157.26666	165		male	9	3	0.36	3
1306	29-May-02	-29.2	157.26666	167		female	6	4	0.53	4

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1307	03-May-02			61		male	0	1		1
1308	03-May-02			93		female	1	2	0.55	2
1309	03-May-02			79		female	1	1	0.53	1
1310	03-May-02			85		female	1	1	0.6	1
1311	03-May-02			92		female	0	3		3
1312	03-May-02			92		female	2	3	0.23	3
1313	03-May-02			92		female	1	2	0.65	2
1314	04-May-02			115		female	4	3	0.41	3
1315	04-May-02			99		female	2	2	0.31	2
1316	04-May-02			80		female	1	2	0.48	2
1317	04-May-02			100		female	2	2	0.25	2
1318	12-May-02			98		male	2	1	0.47	1
1319	17-Apr-02			52		male	0	2		2
1320	23-Apr-02			61		female	0	2		2
1321	29-Apr-02			63		female	0	1		1
1322	29-Apr-02			152		female		5		5
1323	24-Apr-02			61		female	0	2		2
1324	24-Apr-02			110		male	3	2	0.48	2
1325	24-Apr-02			115		female	2	2	0.36	2
1326	24-Apr-02			90		male	1	2	0.28	2
1327	25-Apr-02			142		female	3	3	0.6	3
1328	24-Apr-02			82		male	1	2	0.76	2
1329	24-Apr-02			150		female	6	4	0.08	4
1330	24-Apr-02			157		female	7	3	0.3	3
1331	24-Apr-02			87		female	1	3	0.58	3
1332	29-Apr-02			103		female	2	2	0.22	2
1334	21-Mar-02	-34	158	144		female	4	2	0.6	2
1335	21-Mar-02	-34	158	109		female	4	4	0.19	4
1336	23-Mar-02	-34	161	163		male	7	3	0.28	3
1337	23-Mar-02	-34	161	97		female	2	2	0.15	2
1338	24-Mar-02	-34.5	161	87		male	1	2	0.4	2
1339	24-Mar-02	-34.5	161	208		female	11	2	0.25	2
1340	24-Mar-02	-34.5	161	232		female	10	3	0.27	3
1341	25-Mar-02	-34.5	161	208		female	8	2	0.29	2
1342	25-Mar-02	-34.5	161	185		female	7	3	0.32	3
1343	25-Mar-02	-34.5	161	142		male	4	2	0.21	2
1344	25-Mar-02	-34.5	161	171		female	7	3	0.16	3
1345	25-Mar-02	-34.5	161	180		female	7	2	0.39	2
1346	25-Mar-02	-34.5	161	150		female	9	3	0.25	3
1347	25-Mar-02	-34.5	161	95		male	1	3	0.45	3
1348	25-Mar-02	-34.5	161	115		female	4	3	0.18	3
1349	25-Mar-02	-34.5	161	132		male	4	3	0.21	3
1350	25-Mar-02	-34.5	161	135		female	3	3	0.48	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1351	25-Mar-02	-34.5	161	195		female	9	4	0.37	4
1352	25-Mar-02	-34.5	161	110		female	3	3	0.37	3
1353	26-Mar-02	-34.5	161	162		male	6	3	0.11	3
1354	25-Mar-02	-34.5	161	75		male	1	2	0.46	2
1355	26-Mar-02	-34.5	161	92		male	1	3	0.69	3
1356	26-Mar-02	-34.5	161	165		male	8	3	0.18	3
1357	26-Mar-02	-34.5	161	150		female	6	4	0.34	4
1358	26-Mar-02	-34.5	161	170		female	8	4	0.1	4
1359	26-Mar-02	-34.5	161	97		male	2	2	0.5	2
1360	26-Mar-02	-34.5	161	227		female	18	4	0.15	4
1361	26-Mar-02	-34.5	161	182		female	6	2	0.53	2
1362	26-Mar-02	-34.5	161	127		female	3	4	0.55	4
1363	26-Mar-02	-34.5	161	91		female	1	1	0.68	1
1364	27-Mar-02	-34.5	161	89		female	1	1	0.65	1
1365	27-Mar-02	-34.5	161	109		male	5	4	0.28	4
1366	27-Mar-02	-34.5	161	136		female	8	3	0.16	3
1367	27-Mar-02	-34.5	161	101		male	2	4	0.39	4
1368	27-Mar-02	-34.5	161	181		female	6	2	0.3	2
1369	27-Mar-02	-34.5	161	243		female		5		5
1370	27-Mar-02	-34.5	161	135		male	6	3	0.18	3
1371	27-Mar-02	-34.5	161	140		male	5	2	0.29	2
1372	27-Mar-02	-34.5	161	135		female	2	4		4
1373	27-Mar-02	-34.5	161	100		female		5		5
1374	27-Mar-02	-34.5	161	146		male	6	3	0.13	3
1375	27-Mar-02	-34.5	161	89		female	2	3	0.23	3
1376	27-Mar-02	-34.5	161	130		female	5	3	0.27	3
1377	29-Mar-02	-32	158	149		female	4	2		2
1378	29-Mar-02	-32	158	178		female	13	4		4
1379	29-Mar-02	-32	158	84		female	1	1		1
1380	29-Mar-02	-32	158	124		male	3	2		2
1381	29-Mar-02	-32	158	124		male	4	2		2
1382	30-Mar-02	-32	158	188		female	5	2		2
1383	20-Feb-02			178		male	6	4		4
1384	20-Feb-02			170		female	6	4		4
1385	20-Feb-02			120		female	3	3		3
1386	20-Feb-02			181		female	6	2		2
1387	21-Feb-02			154		male	4	2		2
1388	21-Feb-02			193		female	7	1		1
1389	21-Feb-02			150		female	4	2		2
1390	21-Feb-02			110		male	3	2		2
1391	21-Feb-02			253		female	11	3		3
1392	21-Feb-02			150		male	5	1		1
1393	21-Feb-02			193		female	9	2		2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1394	21-Feb-02			99		female	2	3		3
1395	22-Feb-02			200		female		5		5
1396	22-Feb-02			118		female	4	1		1
1397	22-Feb-02			175		female	7	1		1
1398	22-Feb-02			191		female	9	3		3
1399	22-Feb-02			167		male	5	4		4
1400	22-Feb-02			189		female	7	2		2
1401	22-Feb-02			123		male	3	1		1
1402	22-Feb-02			215		female	14	2		2
1403	22-Feb-02			142		female	4	3		3
1404	22-Feb-02			145		male	6	2		2
1405	22-Feb-02			100		female	2	2		2
1406	22-Feb-02			125		female	2	2		2
1407	22-Feb-02			210		female	9	3		3
1408	23-Feb-02			97		male	2	2		2
1409	23-Feb-02			147		female	4	1		1
1410	23-Feb-02			91		female	1	1		1
1411	23-Feb-02			96		male	2	2		2
1412	23-Feb-02			200		female		5		5
1413	23-Feb-02			187		female	5	3		3
1414	23-Feb-02			155		female	7	2		2
1415	23-Feb-02			88		male	1	2		2
1416	24-Feb-02			128		female	5	1		1
1417	23-Feb-02			123		female	4	2		2
1418	23-Feb-02			117		female	2	3		3
1419	23-Feb-02			162		female	6	2		2
1420	23-Feb-02			85		male	1	1		1
1421	24-Feb-02			105		male	3	1		1
1422	24-Feb-02			162		female	6	2		2
1423	24-Feb-02			172		male	7	3		3
1424	24-Feb-02			209		female	8	4		4
1425	24-Feb-02			99		female	1	1		1
1426	24-Feb-02			177		female	5	1		1
1427	24-Feb-02			112		male	3	3		3
1428	24-Feb-02			179		female	6	2		2
1429	25-Feb-02			118		female	2	1		1
1430	25-Feb-02			250		female		5		5
1431	01-Dec-01			156		male	6	3		3
1432	29-Mar-02	-26.366666	157.25	84		female	1	2		2
1433	29-Mar-02	-26.366666	157.25	178		male	9	3		3
1434	29-Mar-02	-26.366666	157.25	87		male	1	1		1
1435	29-Mar-02	-26.366666	157.25	91		female	1	1		1
1436	30-Mar-02	-26.6	157.25	150		female	6	1		1

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1437	31-Mar-02	-27.216666	157.93333	157		male	6	3		3
1438	31-Mar-02	-27.216666	157.93333	158		female	5	4		4
1439	01-Apr-02	-27.216666	157.83333	143		female	6	3	0.17	3
1440	03-Apr-02	-26.75	158	157		female	7	3	0.5	3
1441	03-Apr-02	-26.75	158	98		male	1	3	0.46	3
1442	03-Apr-02	-26.75	158	113		female	2	3		3
1443	04-Apr-02	-26.5	157.26666	135		male	3	3	0.42	3
1444	04-Apr-02	-26.5	157.26666	105		female	1	2	0.88	2
1445	30-Mar-02	-26.6	157.25	102		female	2	2	0.47	2
1446	29-Mar-02	-26.366666	157.25	163		male	7	3	0.05	3
1447	18-Jul-02	-24	157.45	198		female	9	4	0.28	4
1448	19-Jul-02	-26.7	157.23333	178		male	10	4	0.09	4
1449	19-Jul-02	-26.7	157.23333	146		female	4	4	0.36	4
1450	19-Jul-02	-26.7	157.23333	140		female	4	3	0.53	3
1451	22-Jun-02	-28	157.28333	179		male	11	3	0.3	3
1452	22-Jun-02	-28	157.28333	112		female	4	2	0.2	2
1453	22-Jun-02	-28	157.28333	148		female	6	3	0.14	3
1454	22-Jun-02	-28	157.28333	98		female	1	2	0.43	2
1455	22-Jun-02	-28	157.28333	155		male	6	4	0.42	4
1456	22-Jun-02	-28	157.28333	186		male	6	4	0.32	4
1457	23-Jun-02	-28.25	158.33333	173		male	9	3	0.29	3
1458	23-Jun-02	-28.25	158.33333	172		female	10	2	0.1	2
1459	23-Jun-02	-28.25	158.33333	149		female	6	3	0.19	3
1460	23-Jun-02	-28.25	158.33333	118		female	3	3	0.27	3
1461	23-Jun-02	-28.25	158.33333	165		female	8	4	0.42	4
1462	24-Jun-02	-28.083333	158.08333	106		female	3	2	0.53	2
1463	24-Jun-02	-28.083333	158.08333	95		female	2	1	0.1	1
1464	24-Jun-02	-28.083333	158.08333	170		female		5		5
1465	24-Jun-02	-28.083333	158.08333	162		female	7	3	0.11	3
1466	25-Jun-02	-27.833333	158.41666	165		female	8	3	0.12	3
1467	25-Jun-02	-27.833333	158.41666	172		female	7	4		4
1468	25-Jun-02	-27.833333	158.41666	135		female	6	2	0.23	2
1469	25-Jun-02	-27.833333	158.41666	148		female	6	3	0.19	3
1470	25-Jun-02	-27.833333	158.41666	138		female	6	3	0.38	3
1471	26-Jun-02	-28.166666	158.33333	236		female	10	2	0.29	2
1472	26-Jun-02	-28.166666	158.33333	133		female	6	2	0.08	2
1473	26-Jun-02	-28.166666	158.33333	163		female	5	4	0.64	4
1474	18-Jun-02			207		female		5		5
1475	18-Jun-02			112		male	6	4	0.26	4
1476	18-Jun-02			151		female	3	2	0.5	2
1477	19-Jun-02			159		female	5	4		4
1478	22-Jun-02			159		female	6	4	0.64	4
1479	22-Jun-02			147		female	6	3	0.28	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1480	24-Jun-02			122		female	4	4	0.33	4
1481	24-Jun-02			276		female	12	4	0.31	4
1482	24-Jun-02			122		female	8	4	0.14	4
1483	24-Jun-02			181		female	7	4	0.43	4
1484	24-Jun-02			193		female	10	4		4
1485	24-Jun-02			160		female	5	3	0.18	3
1486	24-Jun-02			152		female	7	4	0.19	4
1487	24-Jun-02			166		female	7	3	0.36	3
1488	29-Jun-02			134		female	5	2	0.08	2
1489	24-Jun-02			164		female	8	4	0.39	4
1490	24-Jun-02			155		female	6	4	0.11	4
1491	25-Jun-02			149		male	6	4	0.44	4
1492	25-Jun-02			153		male	6	3	0.08	3
1493	25-Jun-02			160		female	6	3	0.15	3
1494	25-Jun-02			199		female	10	3	0.07	3
1495	25-Jun-02			146		female	5	3	0.62	3
1496	25-Jun-02			185		female	8	3	0.16	3
1497	25-Jun-02			144		male	5	4	0.45	4
1498	26-Jun-02			120		female	3	2	0.44	2
1499	26-Jun-02			158		male	5	4		4
1500	26-Jun-02			169		female	5	2	0.24	2
1501	26-Jun-02			127		female	4	2	0.45	2
1502	26-Jun-02			158		female	7	3	0.45	3
1503	26-Jun-02			178		female	7	3	0.19	3
1504	18-Jul-02	-33.816666	152.23333	188		male	10	4	0.13	4
1505	22-Jul-02	-33.9	152.05	185		female		5		5
1506	23-Jul-02	-33.9	152.05	112		female	3	2	0.14	2
1507	23-Jul-02	-33.9	152.05	169		female	6	2	0.24	2
1508	23-Jul-02	-33.9	152.05	160		female	7	4	0.35	4
1509	23-Jul-02	-33.9	152.05	233		female	14	4	0.14	4
1510	23-Jul-02	-33.9	152.05	97		male	1	2	0.19	2
1511	23-Jul-02	-33.9	152.05	165		female	6	3	0.77	3
1512	28-Aug-02			103		female	2	1		1
1513	28-Aug-02			93		female	2	1		1
1514	28-Aug-02			104		female	3	2		2
1515	28-Aug-02			93		female	2	1		1
1516	01-Aug-02			214		female	13	2	0.01	2
1517	01-Aug-02			96		female	2	2	0.45	2
1518	01-Aug-02			95		female	2	2	0.24	2
1519	20-Aug-02			88		female	1	2	0.31	2
1520	20-Aug-02			102		female	2	2	0.36	2
1521	20-Aug-02			88		female	2	2	0.19	2
1522	22-Aug-02			167		male		4		4

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1523	22-Aug-02			62		female	0	1		1
1524	22-Aug-02			95		male	2	2	0.2	2
1525	22-Aug-02			90		female	1	2	0.78	2
1526	22-Aug-02			160		female	6	3		3
1527	02-Aug-02			178		female	6	2	0.09	2
1528	02-Aug-02			132		female	5	2	0.18	2
1529	02-Aug-02			125		female	5	3	0.44	3
1530	01-Aug-02			138		female		4		4
1531	01-Aug-02			160		female	9	3	0.06	3
1532	27-Jul-02	-26.166666	154.08333	200		female	7	2	0.32	2
1533	01-Aug-02	-28.916666	154.1	125		female	4	2	0.08	2
1534	01-Aug-02	-28.916666	154.1	115		female	2	2	0.23	2
1535	01-Aug-02	-28.916666	154.1	120		female	4	2	0.19	2
1536	01-Aug-02	-28.916666	154.1	110		female	1	3	0.43	3
1537	01-Aug-02	-28.916666	154.1	115		male	2	2	0.26	2
1538	01-Aug-02	-28.916666	154.1	95		female	2	2	0.28	2
1539	01-Aug-02	-28.916666	154.1	105		female	2	3	0.52	3
1540	01-Aug-02	-28.916666	154.1	135		female	3	1	0.22	1
1541	01-Aug-02	-28.916666	154.1	110		female	3	2	0.29	2
1542	01-Aug-02	-28.916666	154.1	100		female	2	1	0.19	1
1543	01-Aug-02	-28.916666	154.1	130		female	3	2	0.11	2
1544	01-Aug-02	-28.916666	154.1	135		female	4	3	0.17	3
1545	02-Aug-02	-27.5	154.08333	114		female	4	3	0.07	3
1546	03-May-02			104		female	4	3	0.13	3
1547	02-May-02			96		female	1	2	0.47	2
1548	04-May-02			112		female	2	2	0.19	2
1549	19-Sep-02	-26.666666	159.16666	165		female	9	2	0.19	2
1550	19-Sep-02	-26.666666	159.16666	145		female		4	0.29	4
1551	19-Sep-02	-26.666666	159.16666	175		female	8	2	0.23	2
1552	20-Sep-02	-26.416666	159.08333	142		male	7	3	0.08	3
1553	20-Sep-02	-26.416666	159.08333	178		female	6	2	0.19	2
1554	02-Mar-02	-30.783333	153.86666	94		female	1	2	0.24	2
1555	02-Mar-02	-30.783333	153.86666	57		female	0	1		1
1556	02-Mar-02	-30.783333	153.86666	206		female	11	2	0.14	2
1557	02-Mar-02	-30.783333	153.86666	147		male	6	2	0.16	2
1558	02-Mar-02	-30.783333	153.86666	96		female	2	3		3
1559	02-Mar-02	-30.783333	153.86666	90		male	1	2	0.36	2
1560	03-Mar-02	-31.316666	153.83333	143		male	5	2	0.11	2
1561	03-Mar-02	-31.316666	153.83333	85		female	1	2	0.24	2
1562	03-Mar-02	-31.316666	153.83333	114		male	2	2	0.15	2
1563	03-Mar-02	-31.316666	153.83333	170		female	5	3	0.24	3
1564	04-Mar-02	-31.366666	153.88333	80		female	1	1	0.37	1
1565	04-Mar-02	-31.366666	153.88333	84		male	1	2	0.43	2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1566	04-Mar-02	-31.366666	153.88333	108		female	4	2	0.08	2
1567	04-Mar-02	-31.366666	153.88333	82		female	1	1	0.4	1
1568	04-Mar-02	-31.366666	153.88333	106		female	1	1	0.48	1
1569	05-Mar-02	-31.566666	153.96666	90		female		4		4
1570	13-Jul-02	-34.433333	151.48333	113		female	3	2	0.08	2
1571	13-Jul-02	-34.433333	151.48333	74			0	1		1
1572	15-Jul-02	-34.65	151.85	154		female	6	2	0.05	2
1573	15-Jul-02	-34.65	151.85	81			2	3	0.15	3
1574	15-Jul-02	-34.65	151.85	131		male	5	3	0.14	3
1575	15-Jul-02	-34.65	151.85	97		female	1	2	0.76	2
1576	15-Jul-02	-34.65	151.85	120		female	4	2	0.28	2
1577	16-Jul-02	-34.65	151.85	142		female	5	2	0.16	2
1579	16-Jul-02	-34.65	151.85	114		male	2	2	0.42	2
1580	16-Jul-02	-34.65	151.85	77		male	0	2		2
1581	19-Jul-02	-34.933333	152.18333	109		female	2	2	0.13	2
1582	19-Jul-02	-34.933333	152.18333	115		female	2	3		3
1583	22-Jul-02	-34.6	151.58333	93		female	2	2	0.28	2
1584	22-Jul-02	-34.6	151.58333	230		female	11	2	0.12	2
1585	22-Jul-02	-34.6	151.58333	108		female	3	3		3
1586	22-Jul-02	-34.6	151.58333	103		female	2	2	0.03	2
1587	23-Jul-02	-35.6	151.68333	106		male	2	2	0.33	2
1588	27-Jul-02	-34.983333	151.73333	177		female	8	3	0.24	3
1589	28-Jul-02	-35.233333	151.71666	175		female	9	3	0.04	3
1591	28-Jul-02	-35.233333	151.71666	187		female		4		4
1592	28-Jul-02	-35.233333	151.71666	206		female	8	3	0.73	3
1593	31-Jul-02	-35.416666	151.6	151		female	4	3	0.08	3
1594	01-Aug-02	-35.616666	152.05	144		female	4	3	0.05	3
1595	01-Aug-02	-35.616666	152.05	87			1	1	0.37	1
1596	19-Aug-02	-35.133333	151.86666	93		female	1	1	0.6	1
1597	19-Aug-02	-35.133333	151.86666	81		female	1	2	0.3	2
1598	19-Aug-02	-35.133333	151.86666	220		female	12	3	0.29	3
1599	19-Aug-02	-35.133333	151.86666	105		female	3	2	0.09	2
1601	19-Aug-02	-35.133333	151.86666	173		female	9	3	0.08	3
1603	19-Aug-02	-35.133333	151.86666	101		male	1	2	0.36	2
1604	19-Aug-02	-35.133333	151.86666	108		female	2	2	0.11	2
1605	19-Aug-02	-35.133333	151.86666	118		female	5	3	0.31	3
1606	19-Aug-02	-35.133333	151.86666	67		female	0	1		1
1607	19-Aug-02	-35.133333	151.86666	162		female	7	3	0.09	3
1608	19-Aug-02	-35.133333	151.86666	172		female	7	3	0.1	3
1609	20-Aug-02			105		female	2	2	0.16	2
1610	21-Aug-02	-35.066666	151.86666	170		female	9	2		2
1611	21-Aug-02	-35.066666	151.86666	215		female	11	3	0.09	3
1612	21-Aug-02	-35.066666	151.86666	127		female	5	3	0.22	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1613	25-Aug-02	-34.383333	151.51666	146		female	5	2	0.14	2
1614	25-Aug-02	-34.383333	151.51666	110		female	2	2	0.31	2
1615	25-Aug-02	-34.383333	151.51666	132		male	4	2	0.21	2
1616	25-Aug-02	-34.383333	151.51666	212		female		4		4
1617	25-Aug-02	-34.383333	151.51666	78		male	1	2	0.11	2
1618	25-Aug-02	-34.383333	151.51666	93		male	1	3	0.45	3
1619	25-Aug-02	-34.383333	151.51666	116		female	3	3	0.48	3
1620	25-Aug-02	-34.383333	151.51666	111		female	2	3	0.41	3
1621	25-Aug-02	-34.383333	151.51666	201		female	11	3	0.2	3
1622	25-Aug-02	-34.383333	151.51666	142		female	5	3	0.09	3
1623	26-Aug-02	-34.583333	151.78333	158		female	5	3	0.08	3
1624	26-Aug-02	-34.583333	151.78333	87		female	1	2	0.61	2
1625	26-Aug-02	-34.583333	151.78333	224		female	10	2	0.15	2
1626	26-Aug-02	-34.583333	151.78333	102		female	1	2	0.89	2
1627	26-Aug-02	-34.583333	151.78333	149		female	6	3	0.17	3
1629	26-Aug-02	-34.583333	151.78333	149		female	6	2	0.23	2
1630	26-Aug-02	-34.583333	151.78333	162		female	5	3	0.09	3
1631	26-Aug-02	-34.583333	151.78333	112		female	2	3	0.17	3
1632	26-Aug-02	-34.583333	151.78333	163		female	6	3	0.54	3
1633	26-Aug-02	-34.583333	151.78333	83		male	1	2	0.05	2
1634	26-Aug-02	-34.583333	151.78333	125		female	4	2	0.38	2
1635	26-Aug-02	-34.583333	151.78333	101		male	2	1	0.32	1
1636	26-Aug-02	-34.583333	151.78333	145		male	4	3	0.16	3
1637	26-Aug-02	-34.583333	151.78333	97		male	2	2	0.22	2
1638	26-Aug-02	-34.583333	151.78333	184		male	12	3	0.02	3
1639	27-Aug-02	-34.45	151.65	161		female	6	3	0.44	3
1640	27-Aug-02	-34.45	151.65	95		female	1	2	0.58	2
1641	27-Aug-02	-34.45	151.65	91		male	2	2	0.09	2
1642	27-Aug-02	-34.45	151.65	97		female	2	3	0.21	3
1643	27-Aug-02	-34.45	151.65	103		female	2	3	0.28	3
1644	27-Aug-02	-34.45	151.65	163		female	5	3	0.28	3
1645	27-Aug-02	-34.45	151.65	173		male	7	2	0.12	2
1646	27-Aug-02	-34.45	151.65	182		female	6	2	0.21	2
1647	27-Aug-02	-34.45	151.65	112		female	3	3	0.35	3
1648	27-Aug-02	-34.45	151.65	162		female	6	3	0.23	3
1649	27-Aug-02	-34.45	151.65	102		male	1	2	0.5	2
1650	27-Aug-02	-34.45	151.65	166		female	4	3		3
1651	27-Aug-02	-34.45	151.65	100		male	2	2	0.05	2
1652	27-Aug-02	-34.45	151.65	115		male	3	2	0.13	2
1653	27-Aug-02	-34.45	151.65	221		female	12	3	0.04	3
1654	17-Dec-99	-28.741666	157.75833	116		male	2	2		2
1655	16-Oct-99	-26.383333	154.91667	137		male	3	2	0.26	2
1656	17-Dec-99	-28.741666	157.75833	140		female	5	2	0.15	2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1657	04-Jun-02			106		female	2	3	0.26	3
1658	05-May-02			101		female	1	2	0.14	2
1659	06-Jun-02			102		female	1	2	0.86	2
1660	06-Jun-02			110		male	3	2	0.07	2
1661	07-Jun-02			140		female	5	2	0.39	2
1662	30-Apr-02			124		female	2	2	0.07	2
1663	01-May-02			96		female	1	2	0.6	2
1664	01-May-02			97		male	2	2	0.41	2
1665	01-May-02			110		male	1	2	0.68	2
1666	01-May-02			86		male	1	2	0.75	2
1667	15-Feb-02			81		female	0	2		2
1668	24-Feb-02			80		female	1	3	0.21	3
1669	25-Feb-02			82		female	1	1	0.39	1
1670	28-Feb-02			83		female	1	2	0.39	2
1671	02-Apr-02			87		male	1	2	0.3	2
1672	02-Apr-02			85		male	1	2	0.22	2
1673	04-Apr-02			165		female	7	2	0.22	2
1674	30-Apr-02			118		female	2	2	0.87	2
1675	15-May-02			160		female		4		4
1676	16-May-02			112		male	2	2	0.34	2
1677	16-May-02			85		female	2	2	0.18	2
1678	24-May-02			95		female	1	2	0.61	2
1679	24-May-02			92		female	1	2	0.75	2
1680	24-May-02			114		female	4	3	0.08	3
1681	24-May-02			104		female	2	2	0.3	2
1682	24-May-02			86		female	0	2		2
1683	24-May-02			107		female	2	3		3
1684	24-May-02			109		male	2	1	0.39	1
1685	27-May-02			106		female	2	2	0.09	2
1686	15-Feb-02			93		female	3	2	0.12	2
1687	04-Mar-02			150		male	5	3	0.13	3
1688	18-Mar-02			127		female	4	3	0.38	3
1689	06-Jun-02			167		female	6	3	0.56	3
1691	25-Apr-02			100		female	2	2	0.12	2
1692	25-Apr-02			109		female	3	2	0.51	2
1693	25-Apr-02			157		female	6	3	0.37	3
1694	25-Apr-02			52		female	0	1		1
1696	01-Nov-02	-25.766666	111.96666	104		male	4	3	0.06	3
1697	01-Nov-02	-25.766666	111.96666	169		male	7	3	0.27	3
1698	01-Nov-02	-25.766666	111.96666	147		female	5	3	0.25	3
1699	02-Nov-02	-23.75	111.73333	121		female	4	3	0.38	3
1700	02-Nov-02	-23.75	111.73333	161		female	6	3	0.06	3
1701	02-Nov-02	-23.75	111.73333	95		female	3	3	0.19	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1703	06-Nov-02	-20.933333	110.88333	191		female	12	3	0.32	3
1704	06-Nov-02	-20.933333	110.88333	159		male	10	3	0.19	3
1705	06-Nov-02	-20.933333	110.88333	130		male	4	2	0.15	2
1706	08-Nov-02	-21.333333	113.33333	211		female		4		4
1707	08-Nov-02	-21.333333	113.33333	243		female	13	3		3
1708	09-Nov-02	-21.733333	113.51666	194		female	10	3	0.23	3
1709	09-Nov-02	-21.733333	113.51666	216		female	9	3	0.3	3
1710	10-Nov-02	-22.6	113.3	91		female	1	3		3
1711	10-Nov-02	-22.6	113.3	173		female	8	3		3
1712	10-Nov-02	-22.6	113.3	161		female	6	3	0.09	3
1713	10-Nov-02	-22.6	113.3	123		female	4	2	0.12	2
1715	10-Nov-02	-22.6	113.3	92		male	2	2	0.12	2
1716	10-Nov-02	-22.6	113.3	128		female	4	3	0.19	3
1717	06-Nov-02	-20.933333	110.88333	80		female	1	2	0.27	2
1718	06-Nov-02	-20.933333	110.88333	95		female	1	2	0.07	2
1719	06-Nov-02	-20.933333	110.88333	68		female	0	2		2
1720	25-Feb-02			98		male	1	3	0.21	3
1721	25-Feb-02			170		male	8	2	0.09	2
1722	26-Feb-02			90		female	1	1	0.57	1
1723	28-Feb-02			184		female	10	2	0.08	2
1724	28-Feb-02			191		female	11	3	0.18	3
1725	28-Feb-02			164		male	9	2	0.09	2
1726	28-Feb-02			118		female	3	2	0.37	2
1727	28-Feb-02			188		female	10	3	0.08	3
1728	28-Feb-02			106		female	3	2	0.24	2
1729	28-Feb-02			175		female	10	2	0.06	2
1730	28-Feb-02			84		male	0	3		3
1731	28-Feb-02			184		female	9	3	0.28	3
1732	01-Mar-02			122		female	3	3		3
1733	01-Mar-02			88		female	2	3	0.23	3
1734	01-Mar-02			218		female	14	2	0.1	2
1735	01-Mar-02			168		male	7	3	0.2	3
1736	01-Mar-02			183		male	10	3	0.27	3
1737	01-Mar-02			184		male	8	3	0.29	3
1738	25-Mar-02			96		female	2	3	0.12	3
1739	25-Mar-02			146		female	5	2	0.22	2
1740	26-Mar-02			165		female	7	2	0.26	2
1741	23-Nov-02	-27.966666	157.01666	196		female	9	3	0.27	3
1742	23-Nov-02	-27.966666	157.01666	106		female	1	3	0.42	3
1743	23-Nov-02	-27.966666	157.01666	95		female	2	2	0.41	2
1744	23-Nov-02	-27.966666	157.01666	185		female	10	3	0.19	3
1745	23-Nov-02	-27.966666	157.01666	205		male	10	3	0.35	3
1746	23-Nov-02	-27.966666	157.01666	159		male	9	3	0.08	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1747	23-Nov-02	-27.966666	157.01666	191		female	11	3		3
1748	23-Nov-02	-27.966666	157.01666	98		female	2	2	0.33	2
1749	23-Nov-02	-27.966666	157.01666	182		male	11	3	0.21	3
1750	24-Nov-02	-28.166666	157.28333	102		female	1	2	0.45	2
1751	24-Nov-02	-28.166666	157.28333	120		female	4	3	0.24	3
1752	24-Nov-02	-28.166666	157.28333	166		female	7	3	0.26	3
1753	24-Nov-02	-28.166666	157.28333	104		male	2	3	0.27	3
1754	24-Nov-02	-28.166666	157.28333	179		female	7	2	0.04	2
1755	24-Nov-02	-28.166666	157.28333	201		female	12	3	0.3	3
1756	25-Nov-02	-28.366666	157.11666	197		female	8	3		3
1757	25-Nov-02	-28.366666	157.11666	224		female	15	3	0.26	3
1758	25-Nov-02	-28.366666	157.11666	141		male	7	3	0.19	3
1759	25-Nov-02	-28.366666	157.11666	184		female	11	3	0.26	3
1760	25-Nov-02	-28.366666	157.11666	147		female	7	3	0.22	3
1761	25-Nov-02	-28.366666	157.11666	106		male	2	2	0.36	2
1762	25-Nov-02	-28.366666	157.11666	216		female	14	3	0.05	3
1763	25-Nov-02	-28.366666	157.11666	142		female	5	3	0.12	3
1764	25-Nov-02	-28.366666	157.11666	107		female	3	3	0.18	3
1765	25-Nov-02	-28.366666	157.11666	137		male	3	2	0.53	2
1766	25-Nov-02	-28.366666	157.11666	106		male	2	2	0.4	2
1767	25-Nov-02	-28.366666	157.11666	142		female	4	3		3
1768	25-Nov-02	-28.366666	157.11666	88		female	1	3	0.41	3
1769	25-Nov-02	-28.366666	157.11666	204		female	13	2	0.09	2
1770	25-Nov-02	-28.366666	157.11666	194		female	11	3	0.25	3
1771	26-Nov-02	-28.55	157.21666	120		male	2	1	0.55	1
1772	26-Nov-02	-28.55	157.21666	100		female	3	3	0.25	3
1773	26-Nov-02	-28.55	157.21666	161		female	6	2	0.13	2
1774	26-Nov-02	-28.55	157.21666	178		female	6	3		3
1775	26-Nov-02	-28.55	157.21666	141		female	6	3	0.38	3
1776	26-Nov-02	-28.55	157.21666	188		female	9	3	0.11	3
1777	26-Nov-02	-28.55	157.21666	177		male	10	3		3
1778	26-Nov-02	-28.55	157.21666	148		female	8	3	0.08	3
1779	27-Nov-02	-28.016666	157.45	124		female	3	2	0.42	2
1780	27-Nov-02	-28.016666	157.45	144		female	5	3		3
1781	27-Nov-02	-28.016666	157.45	154		male	4	2	0.49	2
1782	27-Nov-02	-28.016666	157.45	178		female	8	3	0.38	3
1783	27-Nov-02	-28.016666	157.45	82		male	0	3		3
1784	27-Nov-02	-28.016666	157.45	84		female	0	2		2
1785	27-Nov-02	-28.016666	157.45	82		male	1	2	0.42	2
1786	27-Nov-02	-28.016666	157.45	109		female	4	3	0.21	3
1787	27-Nov-02	-28.016666	157.45	127		male	5	2		2
1788	27-Nov-02	-28.016666	157.45	117		female	3	3		3
1789	27-Nov-02	-28.016666	157.45	158		female	7	3		3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1790	27-Nov-02	-28.016666	157.45	160		female	6	3	0.6	3
1791	28-Nov-02	-28.083333	157.38333	172		female	8	3		3
1792	28-Nov-02	-28.083333	157.38333	107		female	2	3	0.36	3
1793	28-Nov-02	-28.083333	157.38333	156		male	6	2	0.16	2
1794	28-Nov-02	-28.083333	157.38333	110		male	2	2	0.4	2
1795	28-Nov-02	-28.083333	157.38333	202		female	9	2	0.28	2
1796	28-Nov-02	-28.083333	157.38333	214		female	12	3	0.22	3
1797	28-Nov-02	-28.083333	157.38333	150		male	3	3	0.2	3
1798	28-Nov-02	-28.083333	157.38333	70		female	0	2		2
1799	28-Nov-02	-28.083333	157.38333	181		female	10	3	0.19	3
1800	28-Nov-02	-28.083333	157.38333	176		male	9	2	0.12	2
1801	28-Nov-02	-28.083333	157.38333	226		female	9	3	0.28	3
1802	28-Nov-02	-28.083333	157.38333	176		female	6	3	0.39	3
1803	29-Nov-02	-28.033333	157.48333	174		female	7	3	0.12	3
1804	29-Nov-02	-28.033333	157.48333	157		female	6	2	0.34	2
1805	29-Nov-02	-28.033333	157.48333	177		female	7	2	0.15	2
1806	29-Nov-02	-28.033333	157.48333	75		female	1	3	0.32	3
1807	29-Nov-02	-28.033333	157.48333	108		male	3	2	0.04	2
1808	29-Nov-02	-28.033333	157.48333	92		female	1	2	0.41	2
1809	29-Nov-02	-28.033333	157.48333	152		female	5	2	0.1	2
1810	29-Nov-02	-28.033333	157.48333	207		female	11	3	0.06	3
1811	29-Nov-02	-28.033333	157.48333	162		male	7	3	0.43	3
1812	29-Nov-02	-28.033333	157.48333	94		female	1	3	0.73	3
1813	29-Nov-02	-28.033333	157.48333	123		female	3	3	0.46	3
1814	30-Nov-02	-27.783333	157.51666	189		female	10	3	0.16	3
1815	30-Nov-02	-27.783333	157.51666	154		male	6	2	0.36	2
1816	30-Nov-02	-27.783333	157.51666	213		female	13	3	0.28	3
1817	30-Nov-02	-27.783333	157.51666	88		female	1	2	0.17	2
1818	30-Nov-02	-27.783333	157.51666	188		female	9	3	0.27	3
1819	30-Nov-02	-27.783333	157.51666	182		female	8	3	0.15	3
1820	21-Oct-99	-27.75	155.85000	237		female	15	3	0.06	3
1821	12-Oct-02			110		male	3	3	0.21	3
1822	15-Oct-02	-31.75	157.15	92		female	2	2	0.26	2
1823	18-Oct-02	-30.1	160.9	191		female	7	3	0.26	3
1824	18-Oct-02	-30.1	160.9	115		female	2	3	0.05	3
1825	18-Oct-02	-30.1	160.9	142		female	5	3	0.24	3
1826	18-Oct-02	-30.1	160.9	131		male	5	2	0.16	2
1827	18-Oct-02	-30.1	160.9	183		female	8	3	0.25	3
1828	18-Oct-02	-30.1	160.9	188		male	9	3	0.27	3
1829	19-Oct-02	-30.166666	161.06666	158		male	4	2	0.22	2
1830	19-Oct-02	-30.166666	161.06666	166		female	8	3	0.34	3
1831	19-Oct-02	-30.166666	161.06666	212		female	9	2	0.39	2
1832	19-Oct-02	-30.166666	161.06666	102		female	2	2	0.05	2

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1833	19-Oct-02	-30.166666	161.06666	97		male	2	2	0.51	2
1834	19-Oct-02	-30.166666	161.06666	215		female	11	2	0.07	2
1835	19-Oct-02	-30.166666	161.06666	219		female	10	2	0.27	2
1836	19-Oct-02	-30.166666	161.06666	153		female	6	2	0.2	2
1837	19-Oct-02	-30.166666	161.06666	189		female	10	2	0.16	2
1838	19-Oct-02	-30.166666	161.06666	104		female	4	3	0.24	3
1839	21-Oct-02	-30.1	160.93333	108		female	2	1	0.24	1
1840	21-Oct-02	-30.1	160.93333	181		female	9	3	0.2	3
1841	21-Oct-02	-30.1	160.93333	158		female	8	2	0.19	2
1842	21-Oct-02	-30.1	160.93333	103		female	2	2	0.78	2
1843	20-Oct-02	-30.083333	161.18333	215		female	11	3	0.11	3
1844	20-Oct-02	-30.083333	161.18333	149		female	4	3		3
1845	15-Oct-02	-31.75	157.15	157		female	5	2	0.02	2
1846	15-Oct-02	-31.75	157.15	143		female	8	3	0.07	3
1847	15-Oct-02	-31.75	157.15	94		male	2	1	0.09	1
1848	15-Oct-02	-31.75	157.15	111		female	3	2	0.3	2
1849	15-Oct-02	-31.75	157.15	103		male	4	3	0.13	3
1850	15-Oct-02	-31.75	157.15	140		female	4	2	0.27	2
1851	15-Oct-02	-31.75	157.15	110		male	2	3	0.65	3
1852	15-Oct-02	-31.75	157.15	137		male	5	2	0.1	2
1853	15-Oct-02	-31.75	157.15	90		male		4		4
1854	15-Oct-02	-31.75	157.15	119		male	4	2	0.08	2
1855	15-Oct-02	-31.75	157.15	150		female	5	2	0.35	2
1856	16-Oct-02	-31.55	157.55	113		female	2	3	0.39	3
1857	16-Oct-02	-31.55	157.55	163		female	8	3	0.07	3
1858	16-Oct-02	-31.55	157.55	160		female	6	3	0.11	3
1859	16-Oct-02	-31.55	157.55	132		male	2	2		2
1860	16-Oct-02	-31.55	157.55	108		male	2	1	0.38	1
1861	18-Oct-02	-30.1	160.9	149		male	9	3	0.09	3
1862	18-Oct-02	-30.1	160.9	91		male	1	1	0.37	1
1864	18-Oct-02	-30.1	160.9	144		female		4		4
1865	18-Oct-02	-30.1	160.9	178		female	8	3	0.55	3
1866	18-Oct-02	-30.1	160.9	204		female	10	3	0.57	3
1867	18-Oct-02	-30.1	160.9	148		female	8	3	0.25	3
1868	19-Oct-02	-30.166666	161.06666	145		male	5	3	0.5	3
1869	19-Oct-02	-30.166666	161.06666	120		female	2	2	0.26	2
1870	19-Oct-02	-30.166666	161.06666	139		female	6	3	0.3	3
1871	19-Oct-02	-30.166666	161.06666	117		female	3	3		3
1872	20-Oct-02	-30.083333	161.18333	146		female	4	3	0.1	3
1873	20-Oct-02	-30.083333	161.18333	106		female	2	2	0.25	2
1874	20-Oct-02	-30.083333	161.18333	210		male	15	3	0.09	3
1875	20-Oct-02	-30.083333	161.18333	154		male	5	3	0.2	3
1876	20-Oct-02	-30.083333	161.18333	150		female	6	3	0.11	3

BBL#	DATE	LAT	LON	OFL	LJFL Final	Sex	AGE	Age Confidence	MI	MI Confidence
1877	20-Oct-02	-30.083333	161.18333	200		male	12	3	0.05	3
1878	20-Oct-02	-30.083333	161.18333	105		male	4	3	0.1	3
1879	20-Oct-02	-30.083333	161.18333	123		female	7	3	0.28	3
1880	20-Oct-02	-30.083333	161.18333	128		male	7	3	0.15	3
1881	20-Oct-02	-30.083333	161.18333	184		female	12	3	0.13	3
1882	20-Oct-02	-30.083333	161.18333	209		female	11	3	0.17	3
1883	20-Oct-02	-30.083333	161.18333	111		female	3	2	0.3	2
1884	20-Oct-02	-30.083333	161.18333	127		female	5	3	0.14	3
1885	20-Oct-02	-30.083333	161.18333	142		female	6	2	0.34	2
1886	20-Oct-02	-30.083333	161.18333	129		female	2	3	0.83	3
1887	20-Oct-02	-30.083333	161.18333	154		female	7	3	0.17	3
1888	20-Oct-02	-30.083333	161.18333	118		male	2	3		3
1889	20-Oct-02	-30.083333	161.18333	121		female	4	3		3
1890	20-Oct-02	-30.083333	161.18333	180		female	6	3	0.46	3
1891	21-Oct-02	-30.1	160.93333	111		male	3	3		3
1892	21-Oct-02	-30.1	160.93333	213		female	11	3	0.43	3
1893	21-Sep-02			138		female	4	3	0.43	3
1894	22-Sep-02			175		female	8	3	0.12	3
1895	22-Sep-02			225		female		4	0.28	4
1896	15-Nov-02	-31.15	153.5	77.5		male	1	2	0.13	2
1897	19-Nov-02	-31.15	154.35	175		female	7	3	0.13	3
1901	12-Feb-03	-30.583333	161.13333	173		female	8	3	0.09	3
1904	15-Feb-03	-31.4	167.63333	185		female	7	3	0.14	3
1907	15-Feb-03	-31.4	167.63333	148		male	6	3	0.11	3
1908	15-Feb-03	-31.4	167.63333	171		female	6	3	0.3	3
1909	16-Feb-03	-30.716666	167.7	174		male	9	3	0.1	3
1911	16-Feb-03	-30.716666	167.7	148		male	6	2	0.33	2
1912	17-Feb-03	-30.866666	167.51666	177		male	6	2	0.38	2
1913	17-Feb-03	-30.866666	167.51666	185		male	7	3	0.21	3
1915	21-Feb-03	-29.733333	164.06666	184		female	6	2	0.23	2
1917	23-Feb-03	-28.75	159.65	169		male	6	3	0.15	3
1918	25-Feb-03	-28.866666	156.11666	162		male	8	3	0.14	3