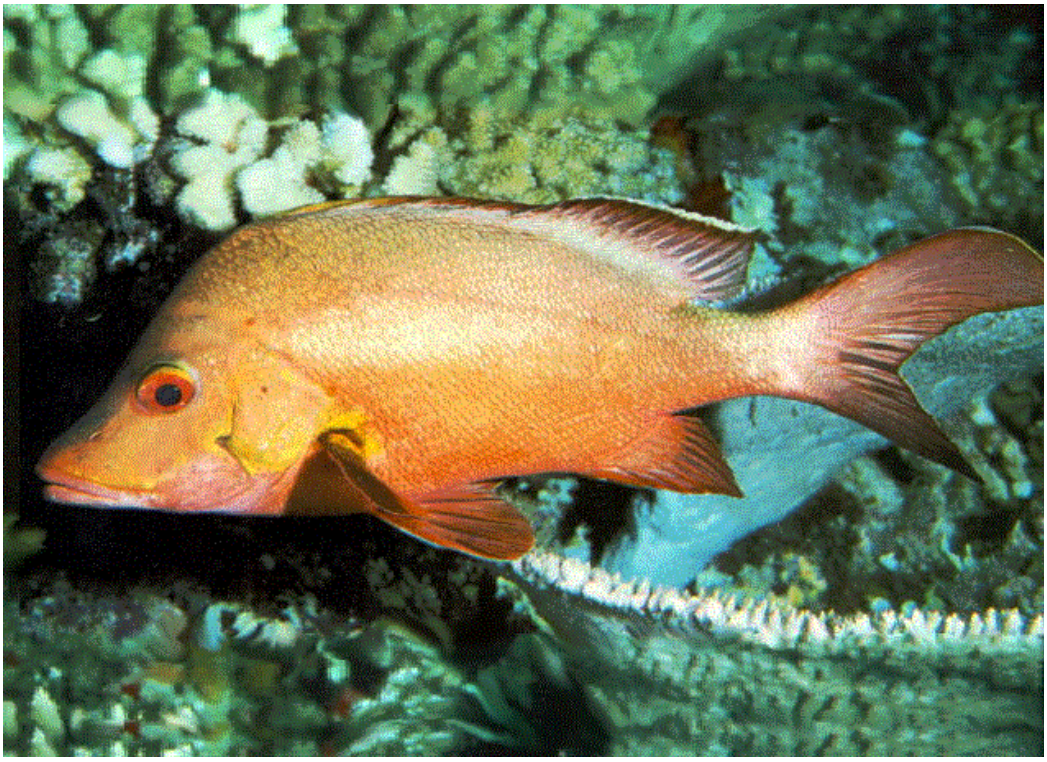
Information Systems for the Co-Management of Artisanal Fisheries

Field Study 2 - Turks & Caicos



UK Department for International Development
Fisheries Management Science Programme
Project R7042

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Information Systems for the Co-Management of Artisanal Fisheries

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Funding: UK Department for International Development (DFID)
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Collaborators: Department for Environment and Coastal Resources (DECR)
South Base
Grand Turk
Turks and Caicos Islands

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1. *Executive Summary*

Complete after CEMARE inputs have been received

2. *Introduction*

2.1 The Objectives of the Project

To enable better management and appropriate development of artisanal fisheries, by developing and testing a generic fisheries information management system (FIMS) suitable for significantly different situations. To achieve this the project will:

a. Describe community and government fishery management objectives for significantly different case study situations.
b. Develop guidelines for appropriate integrated Frame Survey and sampling methodologies
c. Develop a generic data model and prototype FIMS; describe the utility of the generic data model for fisheries
d. Describe the costs of implementing the FIMS at case study sites, and nationally and the unit costs of implementing the FIMS.

This report describes the results of the second field-based case study components of the project which was conducted in the Turks and Caicos Islands between May and June 1999.

2.2 Objectives of the Field Based Study

As outlined in the Project Memorandum, the objectives of the field-based component for each case study site are to:

(i) Establish and describe government and community management objectives
(ii) Establish and describe the evaluation criteria (default indicators and formal and informal models) used to judge the success to which the management objectives are being achieved and to guide management objectives towards the desired objectives.
(iii) Describe the data requirements for (ii) and any shortfalls and future requirements in the light of management plans and future projects.
(iv) Describe the frame surveys and sampling methodologies to meet the data requirements.
(v) Describe the data structures used to store and collate the data.
(vi) Collect and describe example datasets/ databases.
(vii) Establish unit costs to support the existing FIMS.

2.3 Field Study Approach

These objectives were achieved from reviews of published and grey literature, discussions with DECR staff, local fishermen and other stakeholders, surveys of landing sites, and a two day workshop with staff from the DECR. Electronic copies of the department's fisheries database and spreadsheets containing management data and information were collected.

Fishing community objectives were established by.....RL and NF breify summary of your appraches.

2.3 Field Work Team

The field work described in this report was carried out by a multi-disciplinary team from the following collaborating institutes between May 10th and June 12th 1999 (See Annex XX):

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2.4 Structure of the Report

Following this Section, the report is divided in 3 main chapters, and XX appendices. Section 3 provides background on the island's and its fisheries. Section 4 reviews the management of the fisheries including institutional arrangements, the role of the state and the fishing communities, management objectives, models, resource assessments and the management plan. Chapter 5 then identifies the data requirements of both the state and the communities and describes existing and potential sampling methodologies identified from disposition pathways and field appraisals. The existing database and required (future) outputs are also described.

3. The Fisheries of the Turks & Caicos

3.1 Background

3.1.1 Geography and Environment

The Turks and Caicos Islands (TCI) lie 575 miles southeast of Miami, Florida, directly east of Inagua at the Southern extremity of the Bahamas Archipelago and north of Hispaniola, 21º- 22º N and 71º - 72º W (Figure 1). They comprise about 40 low-lying islands and *cays* (islets) in total covering less than 500 km^2 which emerge from 7,500 km^2 of submerged shelf; Turks (324 km^2), Caicos (6140 km^2) and Mouchoir Banks (1109 km^2). The Turks and Caicos groups are separated by the Turks Island Passage, a 35km wide channel approximately 2200m deep which connects the Atlantic Ocean and the Caribbean Seas.

The Turks group to the east of the passage consists of two inhabited islands, Grand Turk and Salt Cay, six uninhabited cays and a large number of rocks. The Caicos group to the west of the passage consist of South Caicos, East Caicos, Middle Caicos, North Caicos, West Caicos and Providenciales, together with a number of islets (Figure 1). Generally, the windward sides of the islands are made of of limestone cliffs and sand dunes, whilst the leeward sides have more lush vegetation. Grand Turk, Salt Cay and South Caicos are very dry having had their trees felled by salt rakers to discourage rainfall.

The Island's banks are very narrow on the northern (Atlantic) shores, but much broader (upto 60km) on the southwest or Caribbean side (The Caicos Bank) where the existing fisheries are concentrated. The banks average 2-6m in depth and slope gently away from north to south. The Mouchoir Bank has no exposed land and averages 20m in depth. These shallow banks are covered with sand, mangrove and turtle grass (*Thallassia* species) which provide habitat for the two major fisheries lobster (*Panulirus argus*) and conch (*Strombus gigas*). Olsen, 1986 provides thematic maps illustrating the distribution and abundance of habitat type on the banks. The shelf edge varies in depth from 20m to 60m, falling swiftly away to the ocean floor. No point on land lies more than 5km from the sea or 75m above sea level and there are numerous lagoons and *salinas* (shallow pools used to produce solar salt).

Temperatures range from 15ºC to 32ºC. Rainfall is low and variable between 530mm and 760mm per annum and water temperatures average 27.4 oC. Oceanographically, the islands are influenced by the Canaries and Caribbean Currents. (Olsen, 1986; Mokoro, 1990; Ninnes and Medley,1995); Cameron, 1998).

The Islands were first inhabited by the Tainos (Lucayan's) peoples in the 16th century and later by Bermudan traders in the 17th who exploited salt for sale to British colonies on the American mainland. The islands were named after the Turk's head 'fez' cactus found growing on the islands. The name caicos comes from the Lucayan *caya hico* for 'string of islands'. Control over the islands alternated between Spain France and Britain until 1766 when it became part of the Bahamas colony, though later abandoned in 1848. Further short links and associations with Jamiaca and the Bahamas finally ended in 1972 when the Island's became a British Crown Colony (now a Dependent Territory). See Cameron (1998) for a review of the Island's history.

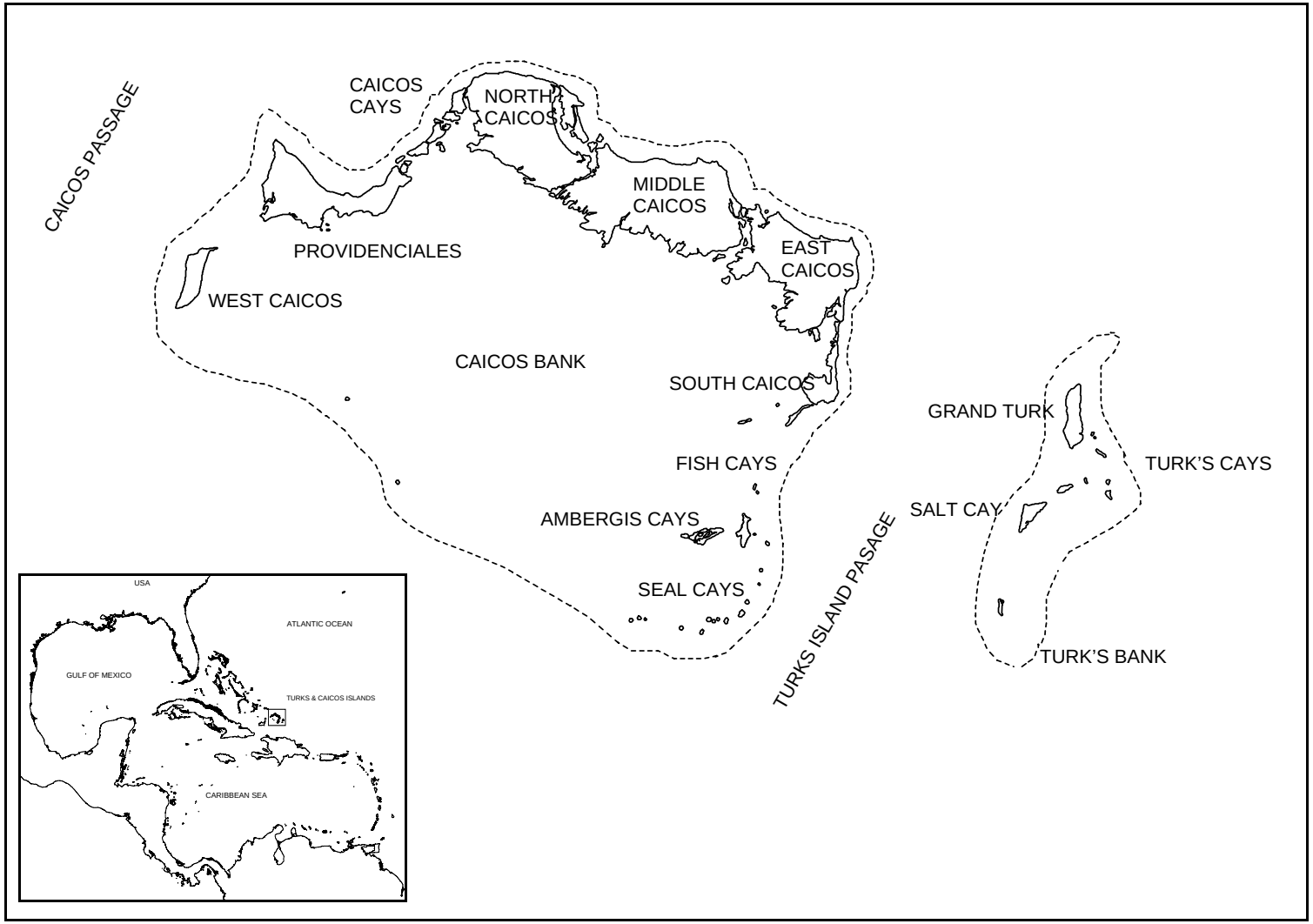

Figure 1 The Turks and Caicos Islands

3.1.2 Demography

The total resident population of the TCI is estimated as approximately 19,000 comprising approximately 8,000 nationals or *belongers* , the remaining being Haitians, Dominicans and North Americans. (Statistical Year Book, 1995; Cameron, 1998). Only six islands are inhabited. More than half the population reside on Providenciales. Population density ranges from approximately 6 to 300 people per square mile (Table 1).

Table 1 Population Number and Density in the Main Turks and Caicos Islands. Source: Statistical Year Book (1995); Cameron (1998).

Island	Population	Area (Sq. miles)	Population Density (Numbers per Sq. miles)
Grand Turk	2000	7	286
Salt Cay	208	3	69
South Caicos	1198	8	150
East Caicos	-	18	-
Middle Caicos	272	48	6
North Caicos	1275	41	31
Providenciales	>10000	38	263
Uninhabited Cays	-	48	-

3.1.3 Government and Economy

The Turks and Caicos Islands are a British Dependent Territory. The British Monarch (Queen Elizebeth II (since 1953) is Head of State who is represented by the the Governor General. The Head of Government is the Chief Minister, supported by locally elected ministers (Figure 2). The cabinets Executive Council comprises three ex-official members and five appointed members appointed by the Governor for the Legislative Council (Fulford, 1996).

Solar salt production was the mainstay of the islands economy at the turn of the century, produced in *salinas* and exported, primarily, to the United States. Various forms of agriculture were attempted including sisal but these failed due to the adverse weather conditions and limited topsoil found on the islands. Other exports included whale products, turtle shells, sponges, dried conch (mainly to Haiti) and canned lobster. In the 1950's the salt market weakened and many residents emmigrated in search of alternative employment. The salt industry finally collapsed in the 1960's and together with the closure of the three US forces bases in the 1970's, employment opportunities diminished further (Sadler, 1997).

The maninstays of the economy are now tourism (Providenciales), fisheries and offshore banking (Grand Turk). Tourism is by far the most important sector of the economy accounting for almost 30% of GDP. During 1994, the islands had almost 75,000 visitors, contributing US$80m to the economy.

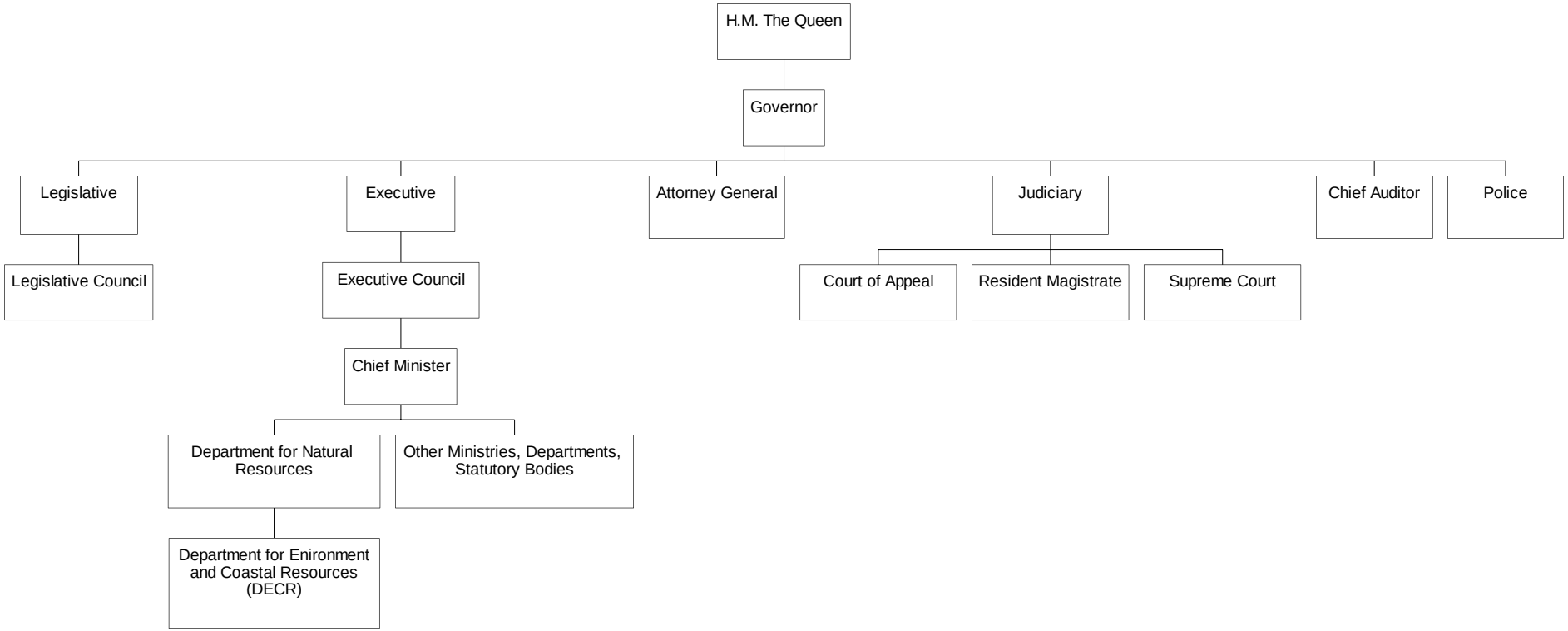

Figure 2 Organogram of the Government of the Turks and Caicos Islands

3.1.4 Fishing and the economy

Presently, the principle exploited resources of the commercial fisheries are lobster and conch centred around a well organised commercial processing sector with nearly all products being exported to the USA. Reef fish including groupers, snappers, grunts and trigger fish, and bonefish are also targeted for subsistence consumption and sale to local hotels and restaurants. Few finfish exports have been recorded (Ninnes and Medley, 1995). This commercial focus is quite distinct from most fisheries within the Caribbean which are mainly directed at finfish for local markets (Harrison, 1991).

Estimated total Gross Domestic Product (GDP) for 1993 was estimates as US$66.8m, of which US$2.82m (approximately 4.2%) was from fisheries. Annual government revenue generated from the fishery is small (approximately US$ 200,000) relative the value of the fishery. Fish products, worth in excess of US$2.6m provided approximately 75% of total export earnings in 1994. Imports of fish products during the same year was estimated as almost US$0.5m (Statistical Year Book, 1995).

Fishing provides an important source of income and employment to those islands where little development has occurred. According to Ninnes and Medley (1995), the fishing sector as a whole provides about 400 jobs in activities, directly and indirectly related to fishing. Presently, the majority of licensed commercial fishermen operate from Providenciales (Figure 3). In 1999, some 30 or so fishermen were known to fish without a licence. From a socio-economic perspective, fishing is most important for South Caicos, where approximately 10% of the population hold commercial fishing licences. The government is the largest employer (1044 persons in 1990) followed by other services (383) and construction (379). The lack of commercial funding has been identified as a major constraint to the development of the fishing industry (Ninnes and Medley, 1995).

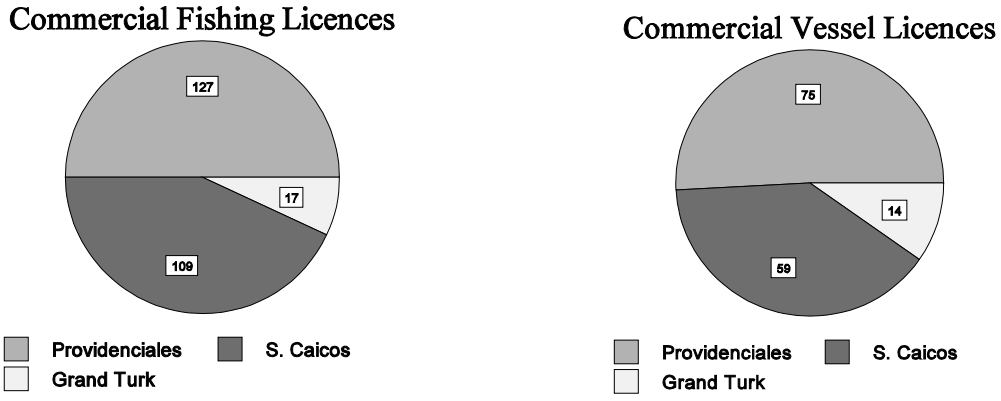

Figure 3 Numbers of licensed (a) commercial fishermen and (b) fishing vessels issued by island in 1998/9. Fishermen residing on other islands are issued licenses at the nearest of the three islands shown. Source: Department for Environment and Coastal Resources.

3.2 Conch

3.2.1 Biology and Ecology

The queen conch, *Strombus gigas* is a large marine gastropod which inhabits shallow banks and seagrass beds throughout the Caribbean. Female conch reach sexual maturity after approximately 3 years. Reproduction occurs by internal fertilization throughout most of the year (February - November), but most intensively during the warmer months (April-September). Sexual dimorphism exists with females approximately 5% larger in shell length and 21% heavier at maturity. Spawning occurs on clear coral sand approximately two to three weeks after fertilization with the females producing an average eight sausage-shaped masses per year, each containing between 300,000 and 400,000 eggs . A pelagic larval stage lasting 2-3 weeks emerges from the egg after approximately 5days. These settle on sand substrate or marine algae and metamorphose into miniature conch. During the first year of life, the juvenile conch burrow into sand substrate during the day, emerging only at night to feed. The diurnal burrowing behaviour continues until the conch attain a shell length of approximately 3". Prior to sexual maturation conch generally inhabit shallow water (<5m) and shell length increases at approximately 3" per annum. At the onset of sexual maturity all shell growth is diverted towards the shell lip which begins to flare, and no further increases in shell length occur. Flaring of the shell eventually ceases, though the lip continues to thicken. Very old conch tend to have rounded shells with very thick lips and shell length may actually begin to decrease as it become eroded. Large animals are generally found in deeper waters. Little is known about larval transport and (stock-)recruitment variability and therefore it is often assumed that the conservation of local stocks will enhance local abundance (Ninnes & Medley, 1995; Chakalall & Cochrane, 1996).

3.2.2 Fishing Operations and Methods

A fishery for the conch has existed for the whole of this century, concentrated almost entirely on the Caicos Bank (Mokoro, 1990). Traditionally, fishing for conch was conducted from small dinghies towed to conching grounds behind locally constructed sailing sloops. Conch were located with a water glass in depths to 7m and caught using a conch hook, a type of pronged rake with tines 7.5cm apart extending 18cm perpendicular to the handle. The conch hook was then worked under the animal and brought to the surface (Olsen, 1986; Ninnes, 1994).

Presently, fishing operations are now conducted from fibre glass boats (*skiffs*) ranging from 4m - 6m in length and powered by 50-120hp two stroke petrol outboard engines. The power and speed of the skiff fleet has increased greatly over the last 20 years, giving fishermen access to distant parts of the bank on a day-trip basis (generally 07:00 - 16:00 depending, among other things, upon the weather conditions). Conch are collected by free diving (only mask, fins and snorkel) in waters less than 10m deep. Although conch aggregations are found down to 20m, fishermen generally do not work in depths greater than 10m because the weight of the shells make it difficult to bring several conch at a time to the surface. Each boat usually carries a boat driver and 1-2 divers (Olsen, 1986; Mokoro, 1990; Medley & Ninnes, 1998).

Mostly, the conch flesh is removed (*knocked*) from the shells at sea by the boat driver while the divers are collecting, so the processing has little effect on catch rates. Search time dominates a conch fishing day so that catch-per-unit-effort (CPUE), measured in kg boat-day^{-1} is therefore likely to be a reasonable index of stock size (Medley & Ninnes, 1998). Conchs are also *knocked* at landing points (see below), evidenced by large piles of conch shells.

3.2.3 Fishing Locations

The main fishing locations for conch are on the Caicos Bank: (i) to the east of West Caicos, (ii) south west of Providenciales, (iii) south-west of South Caicos in the vicinity of Fish and Ambergis Cays, and (iv) north-east of Grand Turk (Figure 4).

3.2.4 Landings

Accurate, but incomplete catch (and effort) data for the conch (and lobster) fisheries on the Caicos Bank are available from 1966 to date from commercial processors landing sheets although verification of these data has only been conducted back to 1977. Historical records are available back to 1904 for conch (Figure 5) and 1947 for lobster. Between 1904 and 1967 conch landings were recorded as numbers landed. Thereafter, landings are recorded in landed weight (lbs). These data do not take account of local consumption and therefore represent minimum estimates for total catch (Ninnes, 1994; Ninnes & Medley, 1995). Olsen (1986) estimated local consumption as approximately 300mt. Estimates of local consumption under various scenarios have been made for stock assessment purposes. Although these estimates are significant, they are not currently included in calculations used to estimate MSY for quota setting purposes (see below). No estimates of catch or effort are available for the Turks and Mouchoir Banks.

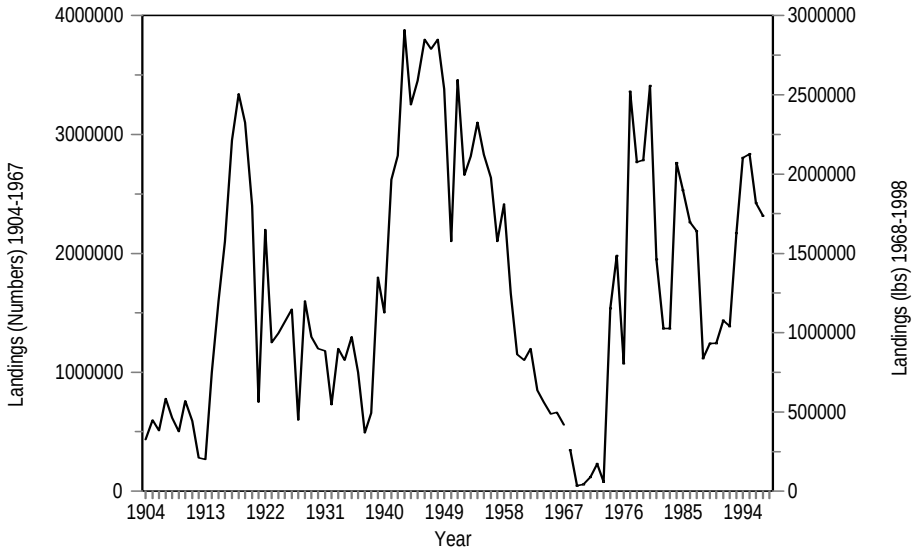

Figure XX Landings of conch from the Caicos Bank in numbers (1904 -1967) and lbs (1968 - 1998). Source: DECR.

The conch fishery has undergone five major production peaks this century, in the 1910's, the 1940's, 1977-1980, 1984-1987 and 1994-1995 (Figure 5). This first two peaks relate to disrupted shipping lanes during the First and Second World Wars which increased the demand for conch for both local consumption, and production of dried conch for trade with Haiti.

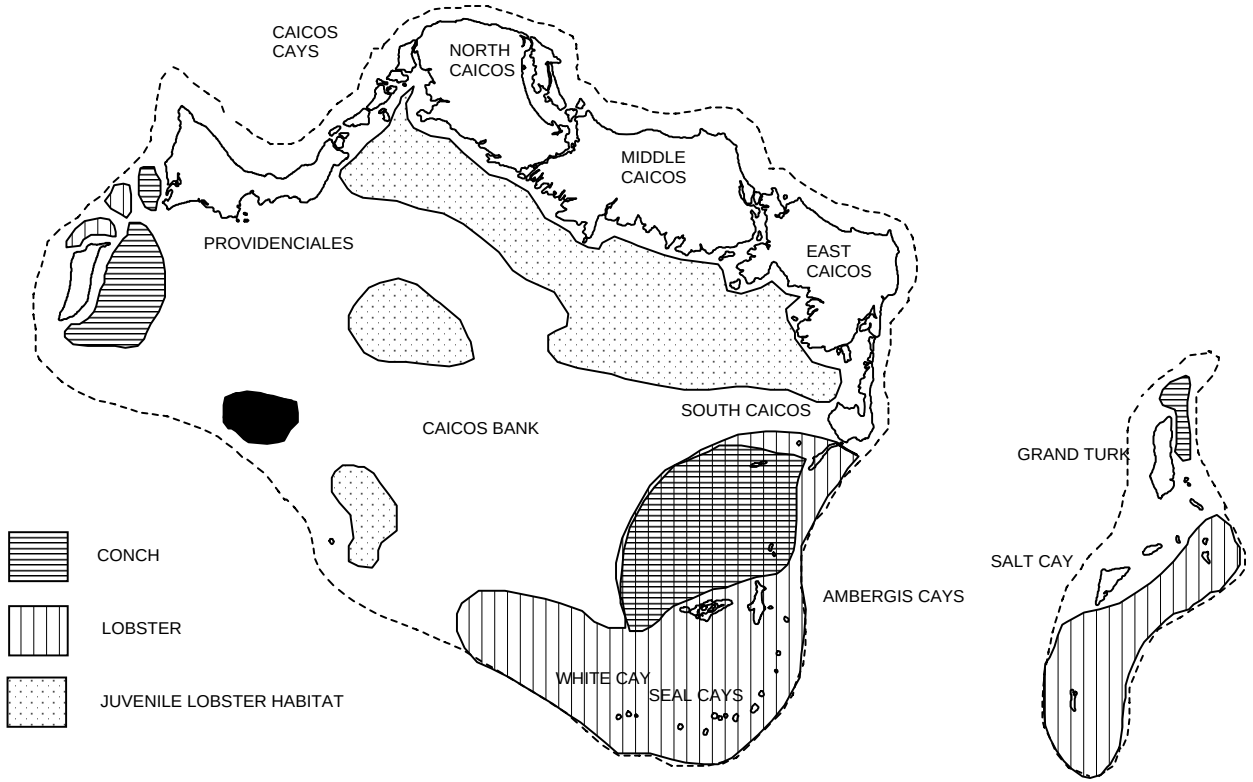

Figure 4 Major conch and lobster fishing grounds in the Turks and Caicos Islands.

The second two peaks relate to rising demand for frozen conch in the USA, high conch prices, and low catch rates in the lobster fishery. Catches during these periods, exceeded sustainable yields and were therefore followed by declining catches (Ninnes & Medley, 1995). The recent peak in catches (1994-1995) probably reflect the effects of improved (quota) management and larger spawning stock biomass following the decline in landings during the late 1980's and early 1990's. In 1998/99, the majority (60%) of the recorded catch of conch was landed to processors on Providenciales.

Seasonality

The same fishermen who fish for conch also fish for lobster. The bulk of the catch is taken during the open season (August to March) for lobster, when fishing effort is most intense. Landings decline from September following the initial lobster 'grab' as effort diminishes in response to the progressive depletion of lobsters. Landings rise after the end of the lobster fishing season (March), as fishermen switch their effort to conch (Figure 7).

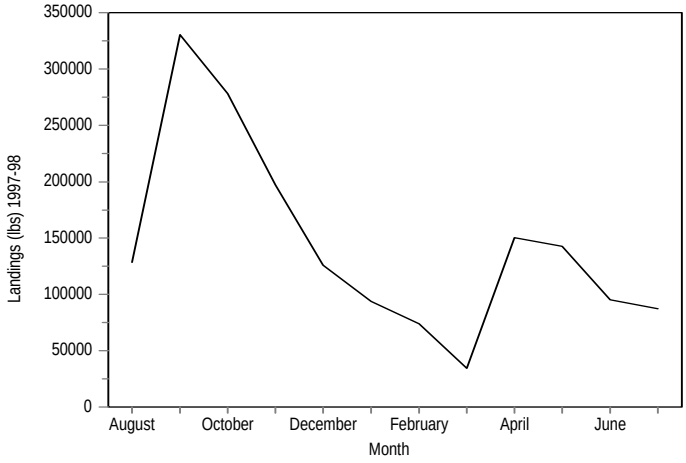

Figure 7 Monthly landings of conch during 1997-98. Source: DECR.

3.3 Lobster

3.3.1 Biology and Ecology

The spiny lobster (*Panulirus argus*) is the single most important reef fishery resource exploited in the Turks and Caicos Islands and throughout the Caribbean (Strum, 1991). It habits reef slopes and coral patch reefs or in solution holes on the seabed. In the Turks and Caicos Islands, female spiny lobster become sexually mature at about 4 years old when they reach approximately 100mm carapace length (Olsen, 1986; Medley& Ninnes, 1997). Reproduction occurs via a spermatophore or sperm plug (tar spot) which is passed from the male to the female lobster. Reproductive activity is greatest during March-August. Fertilized eggs are carried in a mass on the underside to the female lobster and change from bright orange to dark brown as they gradually mature. Eggs are usually released in deep water towards the edge of the bank. A larval stage hatches from the egg approximately the size of a pin head resembling a circular piece of clear glass. The larvae swim to the surface and pass through 7 to 13 development stages before reaching a size of approximately 1.5" in length. It is not known how long

the larvae spend in the surface water layers, nor how far they are carried by currents from where they hatched. Larval dispersal may limited around the Turks and Caicos Islands, since recruitment is significantly correlated with spawning stock biomass (Ninnes & Medley, 1995; Medley & Ninnes, 1997).

At the end of the 7-13 stage, the larvae undergo a final moult and metamorphose into an actively swimming miniature colourless lobster (a puerulus) which settles on suitable substrate and undergoes several more moults, gradually acquiring adult colouration. Juvenile lobsters are usually found at depths of less than 3m, often in aggregations, and grow rapidly to about 3" carapace length in only two to three years. Young lobsters are typically found in shallow bay and reef areas among seagrasses, sponges and coral patch reefs and in solution holes on the seabed. Lobsters recruit to the fishery when they reach 78-83mm (approx 3.25"). Lobster size has been found to increase from shallow water areas to the deep water grounds on the edge of the bank where most (actively) mature animals are found, implying that they migrate to deeper water as they grow (Ninnes & Medley, 1995; Medley & Ninnes, 1997).

3.3.2 Fishing Operations Methods

The fishery for the lobster only began in earnest with the arrival of appropriate freezing technology in 1966, though landings have been recorded since 1947. During the 1950's and early 1960's the main catch methods were traps and bully-nets. Traps were hand hauled on smaller (8-10m) wooden vessels and hydraulically hauled on the larger (15-20m) trap boats. The larger, diesel powered boats tended to fish the outer banks and deeper water, catching larger, mature lobsters. Free diving for lobster grew in importance in the late 1960's and during the 1970's until by 1982, more than 90% of the catch was taken by divers. Then, divers employed the *toss*, a wire noose attached to the end of a pole which was slipped around the tail of the lobster and pulled tight, allowing the capture of only one lobster per dive.

Presently, diving operations are organised in the same way as for conch fishing, indeed, the same fleet now targets both fisheries. Lobsters are caught from their dens when they aggregate during the day. Fishing is largely limited by the number of dens that can be located from the surface. Invisible caves and crevices that cannot be seen from the surface, together with deeper water habitat act as refuges for the lobster population. Lobsters are now mainly caught (illegally- see below) by impaling them on a hook attached to the end of a short fibreglass rod, decreasing the capture time, and allowing the capture of more than one lobster per dive. Similar to the conch fishery, search time dominates the fishing day. Trapping now accounts for only 5-10% of the total catch (Medley & Ninnes, 1997). Simon (1983) as cited by Mokoro (1990), estimated that 10% of South Caicos fishermen engaged in the illegal underwater use of bleach and other notious substances to drive lobsters out of hiding. Bleaching kills the coral and appears to leave the habitat unusable for lobsters for some years after (Mokoro, 1990)

The catch is landed daily to the same processing plants as for conch, and to hotels, restaurants and small beach landing sites (see below).

3.3.3 Fishing Locations

According to Bene (199?), fishing areas for conch and lobster have changed in response to increased

fishing effort and the depletion of resources within nearby fishing grounds In spite of this, all areas of the Caicos Bank are believed to still produce economically viable quantities of lobster. Gitlitz (1992) see Bene (199x) identified a number of factors influencing the choice of fishing location including depth, coral formation type, weather conditions and crew knowledge. Piebenga (1991) as cited by Bene (199X) identified fishing locations targeted by 70 boats operating from South Caicos during a one month period in the autumn of 1991. Locations most frequently visited sites, were ranked in order of importance as: Bush cay; south east of Voice Cay; Fish Cay lake; Phillips Reef/Pear Cay; French Cay; Voice (White Cay); East Cay; south of Six Hills; south of Ambergis Cay; west of Bush Cay; Ambergis Cay and Bell Sound (Figure 4).

3.3.4 Landings

Catches of lobster remained low until 1966 when processing plants equipped with freezing technology were established on South Caicos and Providenciales. Landings rose rapidly between 1966 and 1972, typifying the development stage (Grainger & Garcia, 199X) of a largely unexploited fishery (Figure 9). Catches peaked in 1971, but then declined rapidly towards the mid 1970's as a result of overexploitation. Reduced exploitation intensity over the next four years resulted in a partial recovery of the resource, and eventually to increased landings during the late 1970's. However, there is evidence that some of the increased landings reflected improvements in technology and fishing methods that allowed more effective exploitation of more distant areas of the Caicos Bank. There is also anecdotal evidence that the harvesting of undersize lobsters became more prevalent. Landings declined over the next five years to levels not much higher than those experienced prior to 1966 (Ninnes & Medley, 1995).

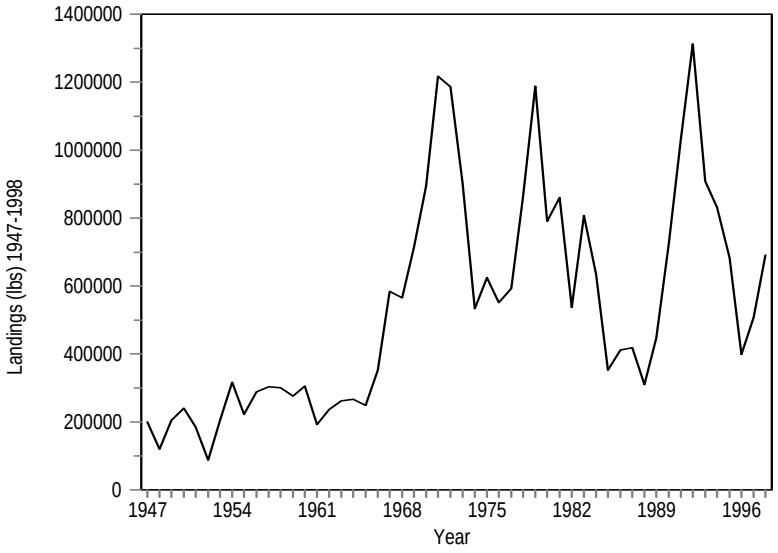

Figure 9 Landings of lobster from the Caicos Bank (1947 -1998). Source: DECR.

This decline is thought to have been exacerbated by the continued harvesting of undersized lobsters and a hurricane in 1985 which caused substantial juvenile mortality. Despite significant reductions in fishing effort, the continued harvesting of undersized lobsters continued to depress catch rates during the late 1980's. Dramatic increases in landings during the early 1990's are believed to have resulted from

reductions in effort from the trap fishery and improved enforcement of the minimum landing size both on the fishing grounds and at processing plants. These dramatic improvements in the catch attracted another surge in fishing effort which depleted the spawning stock and diminished landings between 1992 and 1994. The latest catch statistics suggest indicate that catches are beginning improve once more (Ninnes & Medley, 1995).

In 1998, 60% of the total recorded catch was landed in South Caicos; the remaining 40% was landed in Providenciales. Lobster fishing is regulated with a closed season between 1 April to 31st July (see low). This, together with open access management arrangements makes the fishery highly seasonal (Figure 10). During the 1998-99 season, almost a third of the total annual catch of lobster was landed during the first month of the open season, a period referred to as the 'grab' when newly recruited lobsters are rapidly depleted. Bene (199X) reports that catch and effort often increases in March, just before the close of the season which he explains reflects the abundance of lobsters on the bank at this time, and pressure on fishermen to generate revenue before the season's closure.

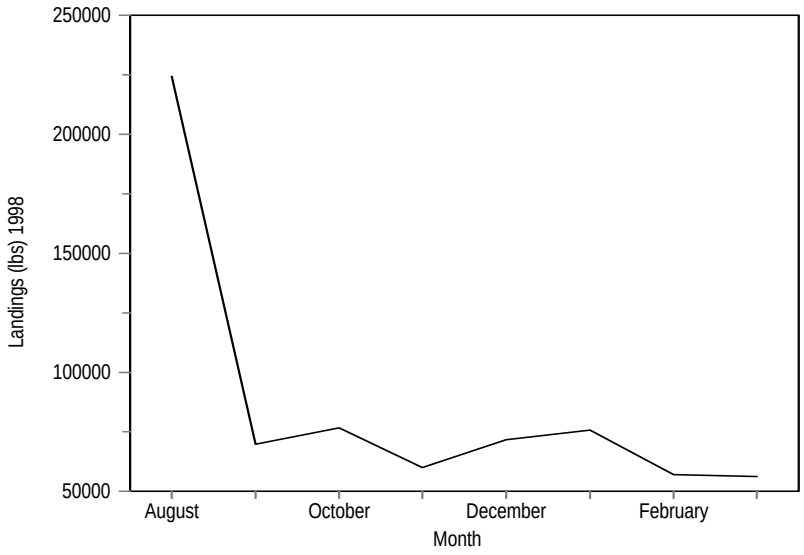

Figure 10 Monthly landings of lobster during 1998-99. Source: DECR.

3.4 Finfish

A long established finfish fishery has existed throughout the islands for a variety of species which are sold mainly to the domestic market, but also to processors. Traditionally, the most important of these have been bone fish (*albula vulpes*), caught on the shallow banks in seine nets, and groupers (especially *Epinephelus striatus*), various snappers, grunts and other reef fish caught over hard ground on the banks or at the edges of shelf with fish traps and spears. A handline fishery also exists for bigeye and blackfish tuna (*Thunnus obesus* and *Thannus atlanticus*), barracuda (*Sphyraena barracuda*) and other inshore pelagics. Finfish are often caught opportunistically by fishermen targeting lobster and conch. Almost all the catch is sold from the boat at small beach landing sites or directly to hotels and restaurants. The decentralised pattern of landings has made it difficult to assess the size of the fishery

(Mokoro, 1991). Olsen (1986) reports landings of 2985 lbs of fish frozen at processing plants between 1976-77, and exports of 7212 to 44659 lbs during 1980-1984. Annual landings of finfish at commercial processing plants recorded by the DECR since 1984 are illustrated in Figure XX.

Between 1980 and 1992, up to 24 Taiwanese vessels leased to a Japanese company, where granted licenses to fish in Turks and Caicos waters. These vessels targeted tuna, swordfish and red snapper around the Gentry Banks with longlines. Reported catches (Figure XX) ranged from 64 to 362 tonnes per season (October to March). No further licences were granted after 1992, through fear that operations would impact on the sports fishing industry (see below) (Ninnes, 1992; Bene, 199X).

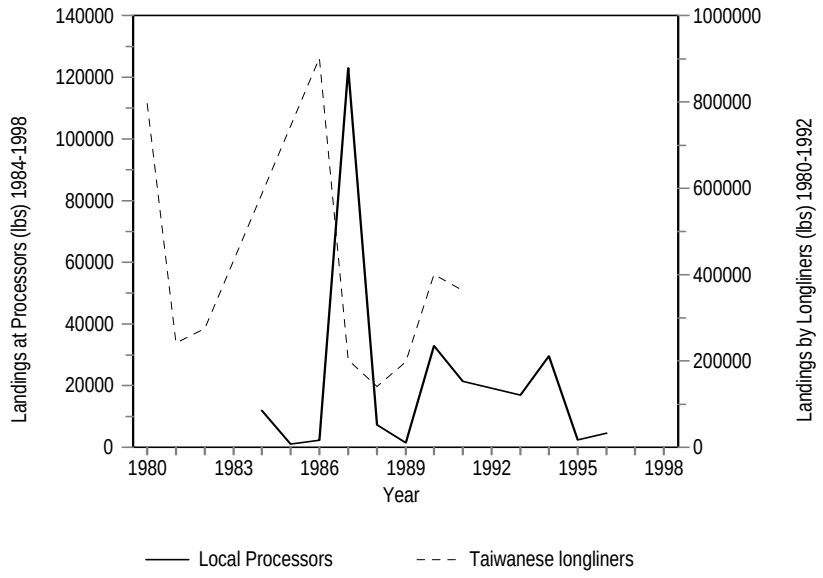

Figure XX Landings of finfish at processing plants from the Caicos Bank (solid line) and by Taiwanese longliners (hatched line). Source: DECR

3.4 Domestic Consumption

Little statistical information exists regarding domestic consumption of seafood. Per capita fish consumption of finfish by nationals has been estimated at 57-78 lbs per annum, the preferred species being bonefish and Nassau grouper. Conch is believed to be eaten with the same frequency as finfish. Comparisons of processors export and landing figures indicate that as much as 100,000 lbs of both lobster and conch may be sold to local markets (Olsen, 1986).

3.5 Processing

Knocked conch are processed at 5 plants, three (Provo Conch & Seafood; T & D Seafood and Turks & Caicos Seafood) based on Providenciales and two (Caicos Seafoods and Henson Import/Export) on South Caicos. Each processor has a 'Weigh Master' who records the whole (knocked) weight from each boat and issues the boat captain with a landing receipt which includes the numbers of fishermen employed on the boat. The boat captain is paid for his catch by the processors secretary on submission of the landing receipt.

Processing involves skinning the columnar muscle and removing the viscera and head before freezing and packing. Processing yields approximately 40% of the total conch weight. Sometimes the skin and trimmings are minced and frozen for use in making conch chowder for domestic and export markets (Mokoro, 1990). None of plants are believed to be operating at full capacity (Harrison, 1991).

Lobster are weighed in the same manner as conch and processed at the same plants. Processing involves removing the tails for washing, size grading and freezing in 5kg packs. Tail yield is approximately 34% of the whole live weight. Meat is sometimes picked from the head and legs of larger lobsters; yield is approximately 20% (Olsen, 1986; Mokoro, 1990). Small quantities of finfish are skinned, filleted, boxed and frozen in a similar manner.

3.6 Fishermen Incomes and Costs

RL & NF

3.7 Recreational Fisheries

Finfish resources are also targeted for recreation. The numbers of fisherman and vessels involved in recreational fisheries are uncertain. Non-belongers fishing from their own boats require only a 'Sports Fishing Licence' but may also fish from a charter vessel which must hold a valid 'Charter Vessel Licence' for fishing as well as for any other charter activity (diving, snorkelling etc). Belongers require an 'Ordinary Vessel Licence' for recreational boat use including fishing. Since recreational vessel licences are not recreation-specific, the numbers issued provide little indication of the magnitude of the recreational fishery. Recreational fisheries target near shore pelagic resources including billfish, marlin, tuna and other sport fish, and bonefish from the Caicos Bank. Little is known of the recreational fisheries in terms of quantity of fish landed and the location of catches (Ninnes & Medley, 1995).

3.8 Mariculture

RL & NF

3.9 Landing Sites

The main landing sites on each island (and the disposition of catches) were identified during a two day workshop held at the DECR on 3rd and 4th of June (see below).

Providenciales

The majority of commercial landings are made in southern part of the island at Five Cays, South Dock Discovery Bay and Sapodilla Bay by approximately 130 skiffs. Leeward Marina at the eastern tip of the island is an important landing site for charter sport vessels. Recreational fishing vessels also land at a few sites on the north coast (Figure XX).

North Caicos
Approximately 12 subsistence fishermen operate from the East coast of the island between Belleview and Belmont (Figure XX). Four skiffs supply two hotels on the north coast (Prospect Whitby and Pelican Beach Hotels). A further 10 skiffs supply hotels on Pine and Parrot Cay's.

Middle Caicos
Only ten skiffs operate from Middle Caicos on a part time basis, landing at Bambara and Conch Bar (Figure XX).

South Caicos
The seventy or so skiffs and the two trap boats that operate from S.Caicos land at four sites clustered around Cockburn Harbour, the only settlement located in the south west corner of the Island (Figure XX).

Grand Turk
The few (approximately 3) full-time commercial fishermen land their catch on beaches and small jetties at five main locations on the east side of the island adjacent to Cockburn Town (Figure XX). Most of the catch is landed 'to order' for the islands hotels which are clustered around the town. A small fish market existed just north of the town between 'Poop Deck' and 'Boat House' until 1996 when it was closed down for not holding an appropriate licence. Conch, lobster and finfish are also sold to the local islanders from 'Poop Deck', 'Boat House' and 'Yula Bean'. Basic processing (filleting of finfish and 'peeling' of conch) is conducted on makeshift filleting tables or on the seawall. The majority of the catch is sold in processed form (DECR pers comms). A processing plant located close to the islands airport is currently under construction. It is thought that this will mainly handle finfish to supply local hotels and for export to other islands (eg Providenciales) and the USA mainland (DECR pers comms).

Salt cay
Fish conch and lobster are landed by less than seven skiffs at only two sites on the west coast of the island: Dean's Dock and Harriet Dock (Figure XX).

3.10 Disposition
Path diagrams (Mahon & Rosenberg, 1988) of the disposition for conch and lobster, and finfish have been constructed for the islands as a whole, to illustrate the disposition of catches from the fishermen, through all participants in the industry, to the end user, to help identify existing and potential data sampling points and sampling tools for the prototype FIMS (Figure XX). These figures were constructed from discussions held with the DECR during the two day workshop and should, therefore, be treated with scepticism until appropriate frame surveys have been undertaken.

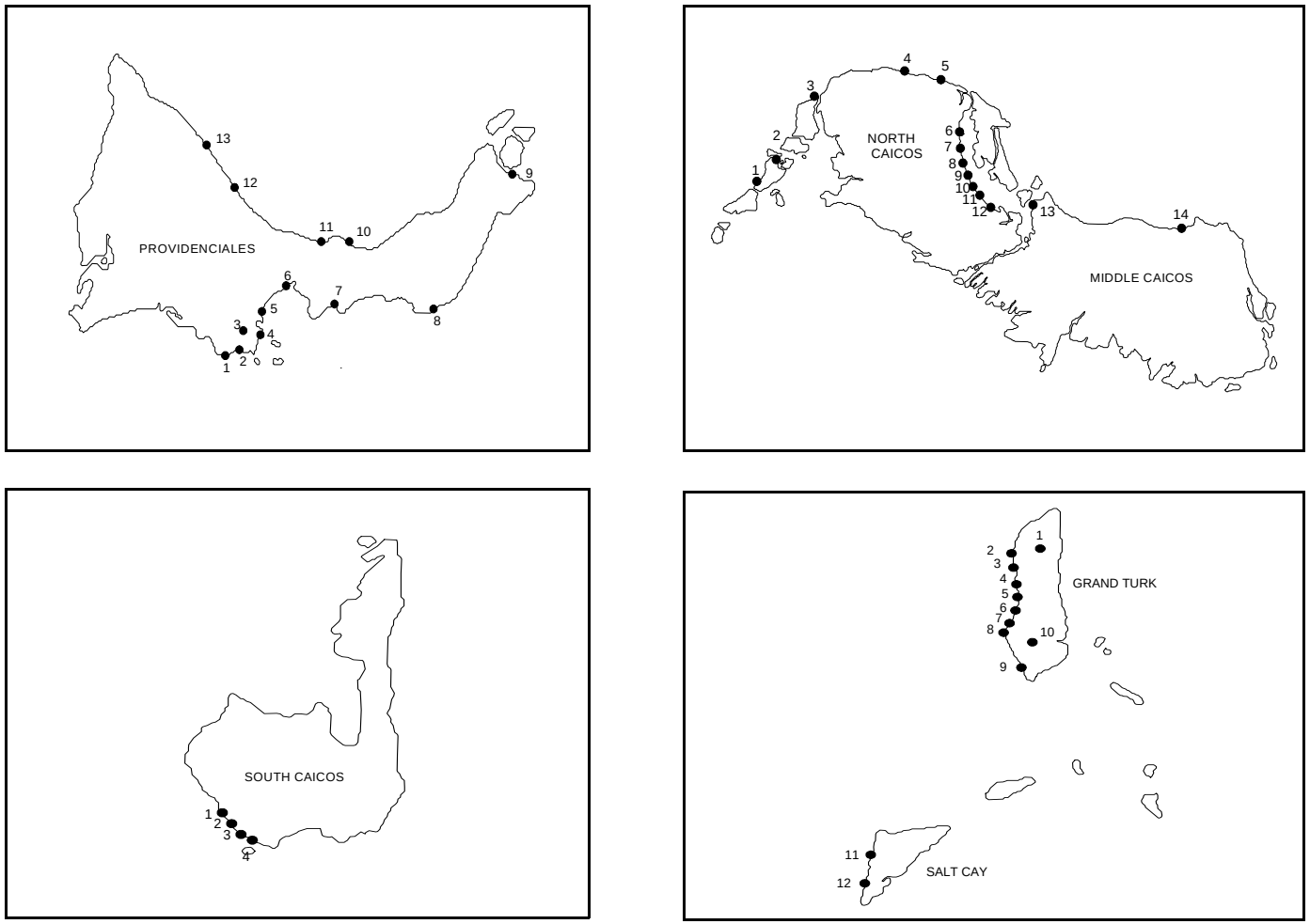

Figure XX Locations of fish landing sites in the Turks and Caicos Islands (see Table XX below for details of each site)

Table XX Key to Figure XX Ordinary licence - required if vessel used for recreational fishing or any other recreational activity.

Providenciales

1. Sapodilla Bay
2. South Dock (15-20 skiffs 1&2 landing to 3.)
3. Turks & Caicos Seafood 1989 Ltd
4. Five Cays (30-35 skiffs landing to T & D Seafood Ltd)
5. Five Keys (60 skiffs landing to Provo Conch & Seafood Ltd)
6. Five Cays (20-30 part time skiffs)
7. Discovery Bay (6 skiffs, 10 ordinary licensed vessels).
8. Caicos Marine Shipyard (10 Ordinary licensed vessels)
9. Leeward Marine (20 Ordinary licensed vessels, 30 sport fishing charter vessels)
10. Turtle Cove Marina (20 Ordinary licensed vessels, 6 sport fishing charter vessels)
11. Thompson Cove Marina (10 Ordinary licensed vessels)
12. Bluehills (6 skiffs mainly targeting finfish)
13. Wheeland (2 skifss mainly targeting finfish).

North & Middle Caicos

1. Meridian Club Jetty (4 skiffs)
2. Pine Cay Jetty (4 sport fishing charter vessels)
3.Parrot Cay Jetty (6 skiffs landing to hotels)
4. Prospect Whitby Hotel (2 skiffs)
5. Pelican Beach Hotel (2 skiffs)
6.Belleview (1-2 skiffs)
7. Bellevedere (1-2 skiffs)
8. North Windsor (1-2 skiffs)
9. South Windsor (1-2 skiffs)
10. Richmond (1-2 skiffs)
11. Laughland (1-2 skiffs)
12. Belmont (1-2 skiffs)
13. Conch Bar (5 skiffs - part-time)
14. Bambara (5 skiffs - part-time)

South Caicos

1. Henson Jetty
2. New Plant Site
3. Caicos Seafood Jetty
4. Fisheries Ice Plant

Sites 1-3 are serviced by approximately 72 skiffs and 2 trap boats. Approximately 7 skiffs land to Providenciales.

Grand Turk & Salt Cay

1. North Creek (12 skiffs operate at the weekend. Makeshift processing facilities.
2.Yula Bean landing site. Makeshift processing facilities.
3.Boat House landing site. Makeshift processing facilities.
4. Poop Deck landing site. Makeshift processing facilities.
5. Turks Head landing site
6. Water's Edge
7. Salt Rakers
8. Sitting Pretty (1 skiff)
9. Arawak Hotel
10. Processing/export facilities under construction.
11. Dean's Dock (2 Ordinary licensed vessels, 3 skiffs)
12. Harriet Dock (2 Ordinary licensed vessels).

Approximately 3 skiffs land to sites 2-9 on a full-time basis).

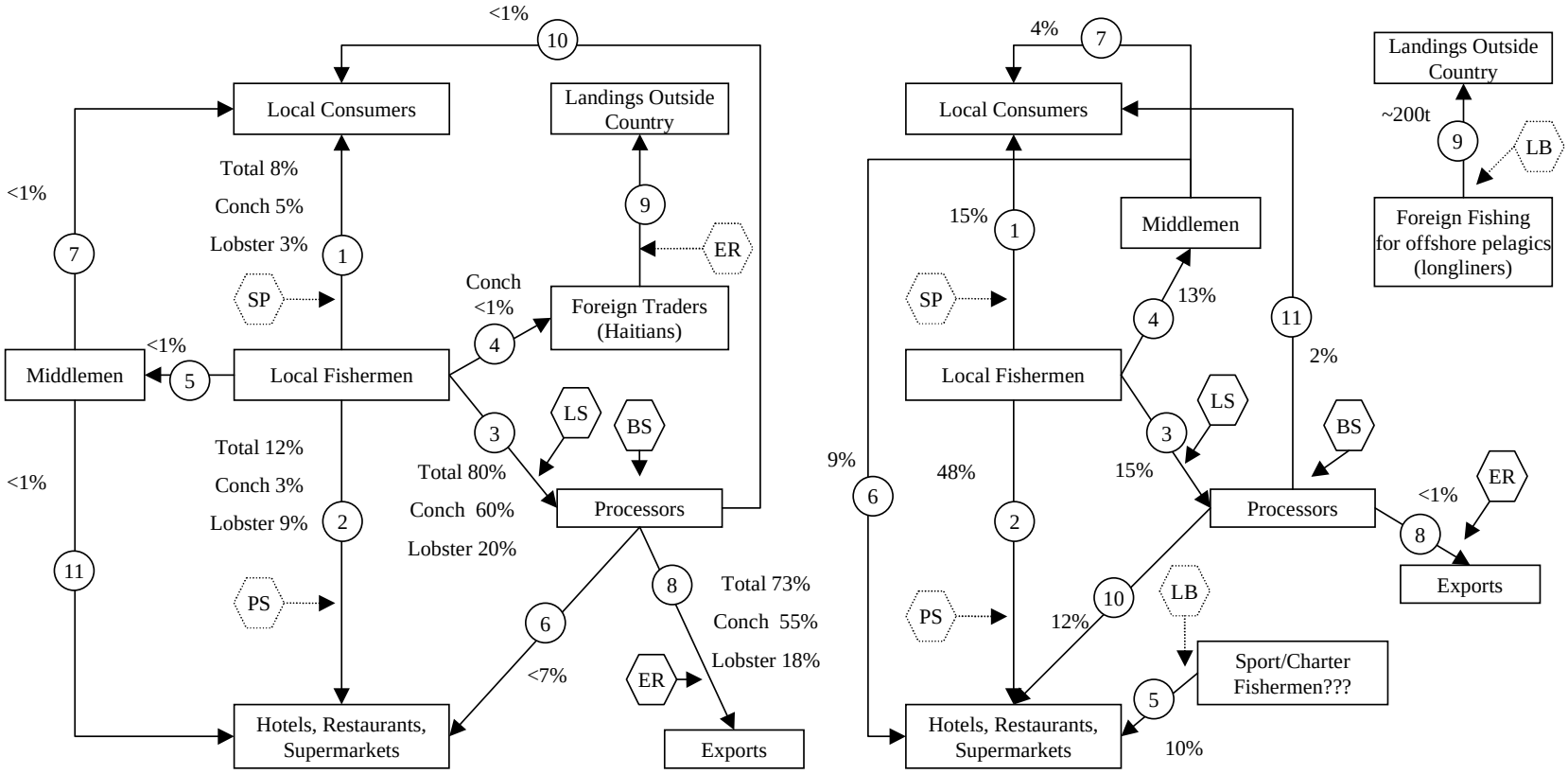

Figure XX Path diagram of the disposition of (a) conch and lobster and (b) finfish in the Turks and Caicos Islands. Percentages indicate tentative estimates moving along each path. Existing (solid lines) and proposed (hatched lines) data collection tools are shown in hexagons (PS - purchase slip, LS - landing sheet, ER -export records, SP - sampling programme, LB - logbook, BS - biological and price sampling).

4. *Fisheries Management*

4.1 *Institutional Arrangements and Responsibilities*

The management of the fisheries resources of the Turks and Caicos Islands is the responsibility of the Department of Environment and Coastal Resources (DECR) which was established in 1994 following the amalgamation of the Department of Fisheries and the Department of Environment, Heritage and Parks. This amalgamation was seen as an important step towards effective integrated coastal resource management. In addition the fisheries resources, the DECR is also responsible for the management of marine protected areas (MPA's), land based parks (protected areas and historical sites), and all renewable and non-renewable resources in an environmentally sensitive manner. This includes coordinating the implementation if international legislation concerned with protecting the environment (MARPOL, Montreal Convention etc) and the rational utilisation of natural resources (CITES, SPAW, Protocol, UNCLOS etc). Other functions include inshore search and rescue, shared responsibilities for the maintenance of navigation equipment and for overlapping responsibilities concerning certain aspects of marine and terrestrial pollution with the environmental Health Department. Future responsibilities may include port state control (Ninnes & Medley, 1995; Fulford, 1996).

The main office of the DECR is located on Grand Turk. The Department also maintains offices on South Caicos and Providenciales. Each Office has a vehicle and a patrol boat. Seven staff are based on Grand Turk, five on Providenciales and four on South Caicos.

The Director of the DECR represents the Permanent Secretary, coordinates joint responsibilities with other Government Departments and has overall responsibility for the management of the Department's activities and staff. Other functions include acting as accounting officer, review and coordination of the implementation of international legislation and the preparation of Executive Council Papers. Immediately responsible to the Director are the Chief Conservation Officer (CCO) and the Chief Scientific Officer (CSO) (Figure 4).

The CCO is responsible is for the coordination of surveillance and enforcement of fisheries regulations (instruments), reviewing local legislation and supervision of CO's. The CCO also acts as liason officer between other enforcement agencies (Customs, Immigration and Police). Other responsibilities include revenue collection and reconciliation at the South Caicos Office, issue of certain licences and CITES permits and acting as chairman of the Fisheries Advisory Committee (see below).

The DCCO is responsible for the supervision of the office and staff on Providenciales, and with consultation with the CCO participates in, and ensures implementation of, all surveillence and enforcement activities in the area of North Caicos, Providenciales, West Caicos and the Caicos Bank west of a line drawn through West Sand Spit (Figure 1). The DCCO will also overseas licence and CITES permit issue, revenue collection and maintenance of licence registers. Conservation Officers are responsible for monitoring and surveillence operations to ensure that management regulations are enforced by carrying out sea and land patrols, the latter at processing plants, hotels, restaurants, airports and land based protected areas.

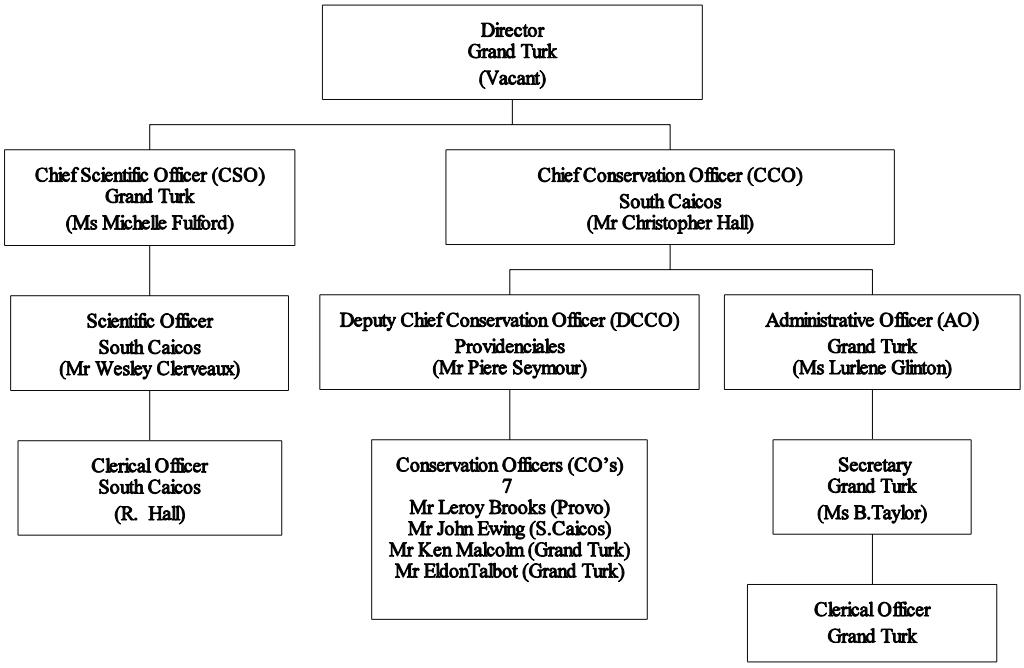

Figure 4 Organogram of the Department for Environment and Coastal Resources (DECR), Turks and Caicos Islands

The CO's are also responsible for issuing licences (when delegated), maintaining licence registers, collection of scientific material and statistics from licensed fishermen and processing plants, distribution of public awareness material and monitoring and maintenance of patrol boats and moorings.

The CSO provides scientific advice to the Director, including coordinating the monitoring of exploited resources to develop and update management plans, scientific appraisal of development proposals and liasing with local and national NGO's and research institutions concerning the development of scientific research programmes conducted locally. Other duties include the preparation of funding proposals for natural resource management plans, staff administration and manpower coordination.

Collection and analysis of additional data for the fishery and its resources including habitat, diving operations, catch and effort and size frequencies is conducted by Scientific Officers (SO's). Their other duties include maintenance of databases and preparation of scientific reports.

Administrative support is provided by the Administrative Officer (AO), the Grand Turk Secretary who is responsible for database entry (licence data, catch/effort etc) and clerical officers. A public relations officer (PRO), based on Grand Turk, promotes marine resource education in schools, designs public information literature and disseminates information to fishermen and other stakeholders.

The DECR is also liases with the National Conservation Committee and the National Trust on issues relating to the management of the environment and protected areas, and with the Fisheries Advisory Committee concerning the management of the island's fisheries (see below).

The Department is funded by a recurrent national budget and revenue raised from the sector through export duty and licence fees. Short term requirements for development are funded through overseas aid, primarily the Department for International Development (DFID).

Fisheries Advisory Committee

NF and RL also see ordinance (ASH has copy)

4.2 National Management Objectives/Policy

The overarching objectives of the DECR are:

"To optimise the financial and social benefits to the TCI's from the sustainable management of all renewable and non-renewable natural resources, particularly those found within protected areas and coastal waters"(DECR, 1995).

These objectives are sought through the formulation and implementation of a scientifically based Management Plan (see Ninnes & Medley, 1995). Management performance is evaluated on the basis of optimal sector contributions to GDP detailed in national statistical summaries and annual reports, in addition to surveillance reports, licence registers, resource use statistics and scientific reports.

4.3 Resource Assessments and Management Models

In response to declining catches reported by a number of workers, a Fisheries Management and Development Programme (1989-1995) was initiated by the Department for International Development (FfID) (formerly the Overseas Development Administration's (ODA)) to investigate the potential of under-exploited resources and to improve the management of exploited fisheries.

The technical management models developed under this programme currently provide the basis to evaluate the success to which management objectives were being achieved, and have, together with resource assessments, been used to develop the TCI's Management Plan. These models (and proposals for their modification and refinement), together with basic default indicators of management success, determine existing and future national data and information requirements of the DECR.

4.3.1 Conch

The fishery for conch is currently modelled using a Schaefer surplus production model, fitted to to historical annual catch and effort data using the CEDA (ODA, 1992) non-equilibrium, least squares fitting procedure. Catch is measured as the total annual (knocked) weight of conch landed at processing plants, and effort as the total annual number of boat fishing days. No account is taken of catches (and associated effort) landed for local consumption (nationals, hotels, restaurants etc) or from the Turks & Mouchoir Banks. Also, no account is taken of the numbers of fishermen operating from each boat or search time. However, the model fits the data well ($R^2 = 0.957$), with an estimated

maximum sustainable yield (MSY) of approximately 1.6 million lbs, corresponding to 5849 boat days per annum. The MSY estimate is currently used to set annual landing quotas at processing plants (see below)(Ninnes & Medley, 1995).

Optimal effort and corresponding optimal catch to achieve maximum economic yield ($F_{MEY,}$) has also been explored by including price, cost and discount rates into a bio-economic Schaefer model (Cunningham *et al,* 1985). Prices and costs are used from 1992, when cost data are available. The average cost of one days fishing was $112 per boat, the average landed price was $0.62 per pound. Assuming a discount rate of 10%, FMEY is estimated at approximately 4500 boat days per annum. The corresponding optimal catch is close to MSY because estimated fishing costs are low (Ninnes & Medley, 1995).

The results indicate the conch stock is currently not over-exploited; biomass was estimated to be approximately 72% of the unexploited biomass in the 1993 season. Controls on fishing effort are currently believed to be unnecessary given the low price for conch and the high catch rates in the lobster fishery (Ninnes & Medley, 1995).

The Conch Tagging Programme
The objective of the tagging study was to provide information on growth, mortality and movement for stock assessment purposes. Due to poor release and recapture rates, the programme has been abandoned.

4.3.2 Lobster
A number of technical management models have been used to explore optimal management of the lobster fishery. For full details of the models see Ninnes & Medley (1995), Medley & Ninnes (1997), and Medley & Ninnes (1998).

(i) *Surplus production models*
A standard three parameter, and an extended seven parameter surplus production models have been fitted to the available catch (total annual weight landed at processing plants) and corresponding effort (total annual boat days) data for the lobster fishery. Similar to the conch assessment, no account is taken of landings for domestic consumption, numbers of fishermen operating from each boat or search time.

The extended model included additional parameters describing variability in (i) recruitment (ii) lobster growth, (iii) handling time for the toss (fitted to data before 1982) and (iii) handling time for the hook (fitted to data for 1982 and after). Neither model were regarded to fit the data well ($R^2 = 0.904$ for the 3 parameter model; $R^2 = 0.901$ for the 7 parameter model).

(ii) *Recruitment Index Model*
A recruitment index model was developed to take account of the large fluctuations in recruitment observed in the lobster fishery. Recruitment at the start of each season was estimated from daily catch (converted to numbers from export size frequency data) and effort data during the first 31 days of the season (August) using a depletion model. The justification for this approach is that the majority

(approximately 70-75%) of the lobsters caught during August represent the seasons new recruits to the stock. Only one catchability, and one natural mortality parameter were estimated for all datasets, but a separate initial population size (recruitment index) was estimated for each season. The total catch and effort for each season was then fitted to a recruitment index model, where the recruitment index at the start of each season was used as estimated initial population size after applying a factor (λ)to convert the recruitment index into absolute numbers.

The recruitment index model provided a much better fit to the data (R^2=0.985) and provides a good basis with which to assess the lobster stock. However, the model is very sensitive to the recruitment index factor and it is remains uncertain how accurate the estimates are. It is also unclear how the index is related to the recruitment of new lobster. That is, the index may also include a proportion of the spawning stock.

The model can be, but is not currently, used to estimate lobster catches for the current year to derive "appropriate management control" (Ninnes & Medley, 1995). Without a stock-recruitment relation, the model cannot be used for guiding long-term management. Spawning stock size entering the closed season in each year has been estimated from the initial population estimates at the start of each year less the estimated recruitment and losses due to fishing mortality. A strong linear correlation (R= 0.59) was found between the recruitment index and spawning stock size four years prior.

(iii) *Analytical dynamic pool models*

Two analytical models were developed. The first, an extended yield-per-recruit model (see Sparre *et al*, 1989) to include price and discount rate was used to test whether the current size limit is optimal. The second, an empirical moult-based model was used to assess losses from fishing pre-moult lobster, and to examine whether a later start to the season would increase income to the fishery (see Ninnes & Medley, 1995).

Yield-per-recruit

von-Bertalanffy growth parameters estimated for the Cuban fishery were used for the analysis. Natural and fishing mortality estimates were taken from the recruitment index model, length-weight model parameters were derived from observations at processing plants. Prices for whole lobster were obtained from landing records ($2.54 per lb) and prices for different sizes of tail weights obtained from Miami markets. The size at last capture (120mm) represents the size at which lobsters escape from the diving fishery when the migrate to deeper waters, out of reach of the divers.

Even taking account of uncertainty in the model parameter estimates, no strong economic evidence was found to support a change to the existing minimum size at first capture (83mm carapace length and 5oz tail weight. However, the optimum minimum size was strongly dependent upon the estimates of natural mortality and discount rates.

Moult Analysis

The underlying theoretical basis of the moult analysis model is similar to the yield-per-recruit model but employs a more realistic growth model which takes account of the discrete pattern of crustacean growth as they moult. The results of the analysis also supported the current minimum size regulation, although an improved growth model, and estimates of natural and fishing mortality could fine tune this

regulation (Ninnes & Medley, 1995).

(iv) *Closed Season Control*

Closed season control was explored to provide guidelines to limit fishing effort to prevent recruitment overfishing. Total effort (boat days) for the fishery was separated into search and handling time based upon a linear relationship between catch and effort between 1997-1993. The estimates handling time per pound of catch for the hook and toss were then used to estimated the total search time (an index of stock density) for each year from the total effort in each year. High search times around 2200 boat days were found to correspond to poor recruitment during 1980-82. A figure of 1800 boat days search time was concluded to be a reasonable limit to prevent further recruitment overfishing. This limit can be implemented through altering the date the season closes, but would require real time monitoring of total boat search days which may be hard to achieve in the DECR at present. August catch, effort and price data can be used to approximately estimate when the season should end. Predictions may be refined following further partitioning of effort into different components which should come with better understanding of the socio-economic of the fishery (Ninnes & Medley, 1995).

The Tagging and Casita Programmes

The objective of the tagging study was to provide information on growth, mortality and movement for stock assessment purposes. Lobster were trapped during a three month period during 1992, tagged with plastic T-bar anchor tags or stainless steel anchor tags, and then measured and sexed before release. Tag loss, and tagging induced mortality rates were high. Poor return rates precluded the use of the data for assessment purposes.

The *casita*[1] (an artificial refuge similar to a trap) programme was developed to replace the tagging programme. Casitas are used as a source of lobsters to tag, to obtain size frequency data, and to provide spatial information about lobster size and abundance. This information can be used to develop recruitment indices to replace the August catch data, and identify suitable closed areas to protect juvenile lobsters.

4.3.3 Finfish Resource Assessments

A survey of deep water demersal resources undertaken in 1990 and 1991 indicated that this resource is limited by habitat availability and slow growth rates (Ninnes, 1993, Ninnes & Medley, 1995). Catch rates for snapper and grouper were found to be similar to those reported for the wider Caribbean and the Pacific. Potential yields, estimated for the Caicos, Turks and Mouchoir Banks were estimated at 31t, 5t and 10t respectively. Olsen (1986) conducted a similar exercise and reported up to ten times higher potential yields. The growth of this fishery is constrained by several factors. Local markets (hotels, restaurants and supermarkets) and export markets must compete both in price and quality with imports and exports (from other countries) through Miami after the payment of export levy and transport costs. Products traded through Miami are often caught using fuel efficient methods in

[1] A box-shaped artificial refuge constructed from corrugated iron and wood. They can be used to improve juvenile survival rates (recruitment), sample the population, and as traps for the commercial fishery.

countries such as Brazil and Argentina where labour costs are low. This contrasts with the relatively inefficient methods used in the Turks and Caicos Islands where fishermen's wage expectations are high. Furthermore, earnings from the deep water demersal resources do not compare favourably with those experienced from the lobster and conch fisheries (Mokoro,1990; Ninnes & Medley, 1995).

Potential yields for near shore pelagic resources were estimated at 67 t and 7 t for the Caicos and Turks Bank respectively. Although the expansion of the commercial fishery is constrained by the same factors identified for the deep demersal resources, it is believed that these and bonefish resources could form the basis of a lucrative sport fishing industry (Ninnes, 1993; Ninnes & Medley, 1995).

Offshore pelagic fish form the largest single resource of the TCI's. This resource has been exploited by Taiwanese and American longliners in the past (see above), but is now largely unexploited. Potential yield has been estimated in excess of 11,000 t, valued at between $10m and $15m. Currently, the TCI's do not have the capacity to police the fishery(Mokoro, 1990).

4.4 Other Programmes

An additional component of the Fisheries Management and Development Programme was the development and use of spatial data to improve the management of the commercial fisheries. The main objective of this component was to develop a habitat map detailing the area and location of habitat important to lobster and conch fisheries. This was to be derived from a Landsat image taken with the Thaematic Map sensor. However, the accuracy and resolution was found to be inadequate for the projects purposes. Attempts to produce a bathymetric chart using GPS systems were also unsuccessful. Ongoing quadrat sampling and visual surveys of habitat type, supplemented by aerial photographs are now being employed to construct a habitat map for the Caicos Bank.

Information on fishing locations, search time and handling (dive times) were also collected with semi-automatic monitoring systems (SAM's). Fishing locations and search time were identified from GPS systems mounted aboard fishermens skiffs. Handling time data were obtained from modified dive computers worn by participating divers. These data will be used to refine indices of lobster and conch abundance (see below).

A number of socio-economic studies were also undertaken including (i) an historic review of the fishery (trends in catches, effort, prices, fishing technology, employment etc), (ii) assessment of fishermen's understanding of their fisheries (iii) assessment of institutional and family arrangements and (iv) review of employment patterns in the processing sector. No documentation describing these studies were available at the DECR.

4.5 Management Instruments and Supporting Legisation

A number of important management instruments and supporting legislation exist to control and regulate the fisheries to meet the objectives set out in the Management Plan:

4.5.1. Exclusive Fishery and Economic Zones

The TCI's have established an exclusive fishery zone under the Exclusive Fishery Zone Act (1966), within which it has sovereign rights and exclusive authority for the purpose of exploiting developing,

conserving and managing the marine and coastal resources of the seasbed, subsoil and adjacent waters. Under UNCLOS III, the TCI's also has fisheries jurisdiction within a 200 mile Exclusive Economic Zone with sovereign rights for exploring and exploiting all living and non-living resources in the water and on the seabed.

4.5.2 Licensing

All persons and vessels involved in commercial and sport fishing or must hold a valid licence. Licences are also required for processing and for importing and exporting marine products. Duties are charged on products for export. Licence types, fees and trade duties are detailed in Anon (1995).

4.5.3 Technical Conservation Measures

Briefly, these measures include:

- Prohibited use of explosives and noxious or poisonous substances eg bleach, quicklime, detergent etc.
- Prohibited use of SCUBA, spear guns and Hawaiian slings for taking marine products.
- A closed areas for lobster and conch known as the East Harbour Conch and Lobster Reserve.
- A closed season for lobster between 1st April to 31st July
- A minimum length at first capture of 3.25" carapace length for lobster (or 5oz tail).
- Prohibited taking of egg or spermatore bearing and soft-shelled lobsters.
- A minimum length at first capture of 7" shell length for conch
- A total allowable catch (TAC) for conch, presently 1.6m lbs (see Table XX below), required under the Convention for International Trade In Endangered Species (CITES).
- A minimum mesh length of 2" for fish traps which must also be fitted with a biodegradable panel.
- A minimum mesh length of 3" for gill, cast and seine nets, except when used for harvesting cultured products or capturing small species.
- A maximum length of 2.5km for drift nets.
- Various (size) restrictions for sponges, turtles and marine mammals and fish aggregating devices (FAD's).
- The southern parts of North, Middle and East Caicos have been designated a wetland of international importance under the Ramsar Convention to protect waterbirds, lobster, conch and a fish nursery area.

Table XX Details of the Turks and Caicos Islands Conch Quota required for CITES

		South Caicos	**Providenciales**
Annual catch quota	1.6m lbs		
Meat	600,000	300,000	300,000
Trimmings	960,000	480,000	480,000
Local consumption	38,000		
Shells	50,000		

Dried conch for export	2,000
Mariculture	
Live conch	300,000
Meat	8,000
Shells	50,000

4.6 Co-Management

NF & RL

the use of a non-fishing zone as a replenishment zone has had fishermen support in the past (Ninnes & Medley, 1995).

Traditional Management?? - none?

Cooperatives

Potential for Co-management

4.7 The Management Plan

The most recent management plan for the commercial fisheries of the TCI's, summarised below, is detailed in Ninnes & Medley (1995) and Medley (1996). The principle objectives of the pan are:

- To increase the contribution the fisheries make to the economy of the islands in general, and government revenues in particular.
- To introduce in the medium term appropriate effort controls (subject to social constraints) to reduce economic inefficiences.
- To reduce the harmful fishing methods by introducing alternative fishing methods
- to introduce the time collection of scientific data for developing fisheries.
- To promote the involvement of the capture and processing sectors, and the general community, as appropriate, in the planning and decision making.

Plans for each sector are summarised below:

Lobster

The principle objectives for the lobster fishery are to reduce fishing effort, to improve control over the size at first capture, to improve contributions to the economy and government revenues, and to eliminate catches during the closed season. These are to be achieved by:

- the designation of a closed area to protect abundant juvenile lobsters found in this area; (referred to as Zone A in the Management Plan).

- the designation of an area (referred to as Zone B in the Management Plan) where fishing by hook is prohibited, but where non-distructive methods are (eg trap-casitas or the toss) are permitted. This is designed to protect juvenile lobsters, and to allow the live capture of larger lobsters which potentially command a higher price. Casitas deployment and maintenance, and zone demarcation will be funded by the DECR through increased licence fees;

- varying the date at which the lobster season ends by up to two months earlier than at present, based upon August catch, effort and prices (see above);

- restricting the number of traps (and/or trap hauls) to be used to protect the spawning stock. It is proposed to issue licences in units of 50 traps, to a maximum of 600 traps. Size frequency and fecundity sampling from trap catches should continue;

- the gradual raising of direct revenues from the industry (license and export/import fees) to cover the costs of enhanced management. Employment trends and other socio-economic data should be collected.

- restriction of foreign nationals fishing commercially.

Conch

The conch stock is believed to be currently in a healthy state and high catch rates are attracting more fishermen. Although catches are predicted to increase in the short term, the current price of conch (and the higher earning potential of the lobster fishery) will make it unlikely that effort controls will be needed in the immediate future (Ninnes & Medley, 1995). However, a closed season has been proposed between 1st July - 31st September each year, to avoid reaching the quota limit before the end of the year (Medley, 1996).

Deep water demersal resources

Unless economic returns for the deepwater finfish fishery improve relative to the lobster and conch fisheries, active management will not be required to limit fishing effort. Future development should only be encouraged if local markets are to be supplied. Vessels fishing this resource should be required to report catch statistics (fishing effort eg line hours, fishing locations and species composition of the catch) to the DECR. The DECR should also endeavor to collect size and weight data.

Near shore pelagic resources

The sport fishing sector should be developed and promoted and charter vessels should be encouraged to return catch and effort (and size frequency) data to the DECR. Exclusion zones for commercial longliners should be established to reduce conflict between sport and commercial fishing activities.

Bonefish resources

The magnitude and extent of the sport and commercial bonefishing sectors should be assessed, and the development of fishing zones for each sector should be considered to reduce conflict. Sport fishing for bonefish should be developed and promoted in the same as the sport fishery for near shore pelagic

resources.

Offshore pelagic resources
The licensing of Taiwanese longliners should continue, and licensing of other fleets, eg the US swordfishing fleet should be considered. All licensed vessels should be required to make port visits to assist in the collection of catch and effort data. Active participation in the regional management of these resources should be established.

Co-Management
The DECR supports co-management as an effective means of enforcement of management instruments. A greater understanding of the need for management and the promotion and support of the management plan is sought from women who influence the fishing community, boat captains who have a log term interest in the fisheries, children who represent the future fishing community and conservation officers who are often in a position to explain fisheries management and conservation issues to the public. Approval and contributions to the Management Plan are also sought from The Fisheries Advisory Committee.

Implementation
Implementation of the management plan is described by Ninnes & Medley (1995).

4.5 Future Scientific Research
The proposed Management Plan is based upon the analysis of historic catch and effort data, and other scientific data collected during the Fisheries Management and Development Programme. These analyses and plans are not definitive and a number of major further research requirements have been identified by the Fisheries Management and Development Programme and DECR (Ninnes & Medley, 1985):

- Determine the validity of current abundance indices with SAM vessel monitoring and casita programmes.
- Develop and improved growth model and estimates of natural mortality from data derived from the casita programme for improved yield-per-recruit analysis and refinement of the recruitment index model.
- Development of a stock-recruitment relationship for the lobster population model with information on lobster fecundity and spawning periods and an improved growth model.
- Explore alternative measures of recruitment indices and enhance the existing index using post-larvae collectors and casitas.
- Develop a model of lobster movement and a habitat map from estimates of local abundance and size frequency from the casita programme and from data derived from the SAM system programme.

- Examine the spatial distribution of effort with the SAM system. Obtain fishing cost data from the SAM system.

- Extension of existing models to include socio-economic information derived from the socio-economic programme and cost data derived from SAM programmes.

- Determine spatial abundance and size of lobsters and profitability of different fishing locations to identify suitable closed areas.

- Produce habitat maps for each bank to identify appropriate locations for the deployment of casitas, the vessel monitoring programme and the demarcation of closed areas. Produce terrestrial habitat maps to aid a more holistic approach to resource management and protection of biodiversity.

5. Development of a Co-Management FIMS

This final chapter begins by describing the DECR's existing FIMS and proposals for it's refinement including data collection methodology, the structure of the existing database, and the required outputs of the FIMS. The second section then examines the objectives and information requirements of the Island's fishing communities.

5.1 The Existing FIMS and Proposals for Future Refinement

The DECR's existing FIMS and proposals for refinement are examined in two subsections. The first examines existing and potential refinements to data requirements, sources of data, data collection methodology and the required outputs from the FIMS. The second section describes the existing database.

5.1.1 DECR Data Requirements, Sources and Collection Methodology

Data and information requirements are dictated by management objectives and responsibilities, and the evaluation criteria (defaults indicators and management model reference points) used to judge the success to which the objectives are being achieved. Information requirements are also dictated by management activities or instruments used to regulate or control the fishery such as license records, and other information required for the general administration and reporting of the management system such as export and revenue earnings data.

The existing and potential data and information requirements, data sources and collection methodology were identified from the management plan, management models and resource assessments, the catch disposition pathways (see above), and from discussions with the DECR during a two day workshop held at the Department on the 3rd and 4th of June 1999 (see Annex XX).

This information has been summarised in Tables XX - XX, structured around data requirements for the existing management models and their potential refinements for each resource, and the Department's administrative and reporting information requirements. The tables also indicate whether or not the data and information should be included in a prototype FIMS based upon a combination of factors including the Department's existing institutional capacity and resources, the quantity and completeness of the data and proposed extensions to the data collection programmes.

Almost all the data required for the management models and resource assessments are currently collected from processing plants (Tables XX) which are required to submit landing sheets to the DECR each month (See Annex XX). These landing sheets contain the name of the boat's captain, and the corresponding landings from each boats on each day of the month. Total effort corresponds to the number of boat days in each month. Previously, the total numbers of fishermen on each boat were also recorded. Now it is assumed that the average number of fishermen per boat is 2.5. Price information is occasionally added to the landing sheet by the processor. During the workshop it was agreed that this data, including price, should continue to be collected on a monthly basis from all processing plants and included in a prototype FIMS A programme to sample biological and price data for lobster, conch and finfish from processing plants was proposed by Medley (1996 p26) but has not begun to date. This should begin as soon as possible, and provision should be made to include the data in the FIMS.

Table XX Summary of the existing and potential sources of data and collection methodology for conch management. DB- Database, SS- Spreadsheet, C.O.- Conservation Officer, S.O. - Scientific Officer.

General Objectives	Management Models	Reference Points/ future model extensions	Data Requirements	Current / Proposed Sources of Data	Current / Proposed Data Collection Tools	Frequency	Entered (DB or SS)	Include in FIMS? (Y/N)	Comments
Maximise sustainable economic and social benefits.	Bio-economic Surplus Production Model	F_{MSY}, F_{MEY}	Total annual catch	Daily Landings by boat at processing plants Hotels/Restaurants (Proposed)	Landings sheets submitted by processors Purchase Slips (Proposed)	Monthly	DB& SS	Y	see example landing sheets
			Total annual effort	Daily number of boats (and number of fishermen) landing at processing plants Hotels/Restaurants (Proposed)	Landings sheets submitted by processors Purchase Slips (Proposed)	Monthly	DB &SS	Y	Effort to be refined with SAM data
			Fishing cost per boat day	Socioeconomic study.			-	N	No supporting documentation
			Unit price of conch at landing site	Landings sheets submitted by processors	Landings sheets submitted by processors	Monthly	DB & SS	Y	See example landing sheets
				Processing plants (Proposed)	Price form completed by C.O.'s (Proposed)	Monthly	-	Y	See Medley (1996, p26) recording sheet: "datsheet.wb1"
			Consumer price index	Internet	PC	Yearly	SS	N	See Medley (1996, p29) recording sheet: "cpi.wb1"
			Discount rate	Fixed at 10%	-	Yearly	-	N	Single value
	Future model development	Indices of recruitment & spawning stock biomass	Weight /sex and sexual maturity	Landings at processing plants (5 boat sub-sample from each processor) (Proposed)	Biological sampling form completed by C.O.'s (Proposed)	Monthly	-	Y	See Medley (1996, p27) recording sheet: "datsheet.wb1"
		Recruitment indices	Weight/size and sexual maturity structure of population	Wild population	Sub-sampling by S.O.	Ad hoc	SS	Y	See Medley (1996, p4) see faxed forms

Table XX Summary of the existing and potential sources of data and data collection methodology for lobster management**.** NS - Not Stated.

General Objectives	Management Models	Reference Points or model future extensions	Data Requirements	Current / Proposed Sources of Data	Current / Proposed Data Collection Tools	Frequency	Entered (DB or SS)	Include in FIMS? (Y/N)	Comments
Maximise sustainable economic and social benefits.	Recruitment Index Model & Closed Season	F_{MsY}, F_{MEY} from predicted catch rates in current season.	Total annual catch	Daily Landings by boat at processing plants Hotels/Restaurants	Landings sheets submitted by processors Purchase Slips (Proposed)	Monthly	DB& SS	Y	see example landing sheets
			Total annual effort	Daily number of boats (and number of fishermen) landing at processing plants Hotels/Restaurants (Proposed)	Landings sheets submitted by processors Purchase Slips (Proposed)	Monthly	DB &SS	Y	Effort to be refined with SAM data? Where is SAM data held / reports?
			Population size structure and age/sex/size at maturity	Exports by tail weight	Export Records	Monthly	SS	Y	See Medley (1996, p28) Data in: SFEXP.wb1
				Landings at processing plants (5 boat sub-sample from each processor) (Proposed)	Biological sampling form completed by C.O.'s (Proposed)	Monthly	-	Y	See Medley (1996, p27) recording sheet: "datsheet.wb1"
			Unit price of lobster at landing site	Landings sheets submitted by processors	Landings sheets submitted by processors	Monthly	DB & SS	Y	see example landing sheets
				Processing plants (Proposed)	Price form completed by C.O.'s (Proposed)	Monthly	-	Y	See Medley (1996, p26) recording sheet: "datsheet.wb1"
	Future model development	SRR	Population size structure and age/sex/size at maturity/fecundity/improved growth model	Casita programme/ sampling from trap fishery (Proposed)	NS	NS	-	N	Ninnes & Medley (1995, Annex 7) No documentation
		Independent estimates of *M*	Numbers at age	Casita/tagging study (Proposed)	NS	NS	-	N	Ninnes & Medley (1995, Annex 7) No documentation
		Alternative recruitment indices	Relative numbers at age or size frequencies	Casita programme / post-larvae collectors (Proposed)	NS	NS	-	N	Ninnes & Medley (1995, Annex 7) No documentation

Table XX (continued) Summary of the existing and potential sources of data and data collection methodology for lobster management. DB- Database, SS- Spreadsheet

General Objectives	Management Models	Reference Points or model future extensions	Data /Parameter Requirements	Current / Proposed Sources of Data	Current / Proposed Data Collection Tools	Frequency	Entered (DB or SS)	Include in FIMS? (Y/N)	Comments
Maximise sustainable economic and social benefits.	Yield-per-recruit & Moult Model	Maximum value per recruit	Natural Mortality	Recruitment Index Model	-	-	-	N	Ninnes & Medley (1995, Annex 7)
			Fishing Mortality	Recruitment Index Model	-	-	-	N	Ninnes & Medley (1995, Annex 7)
			Age/size at last capture	Exports by tail weight, excluding trap caught	Export Records	Monthly	SS	Y	See Medley (1996, p28) Data in: SFEXP.wb1
			VBGP's	Estimates for Cuba from Literature	-	-	-	N	Ninnes & Medley (1995, Annex 7)
			Length-weight parameters	Landings at processing plants (5 boat sub-sample from each processor) (Proposed)	Biological sampling form completed by C.O.'s (Proposed)	Monthly	-	Y	See Medley (1996, p27) recording sheet: "datsheet.wb1"
			Price at size	Miami Data	-	-	-	N	Ninnes & Medley (1995, Annex 7)
			Discount rate	Fixed at 10%					Ninnes & Medley (1995, Annex 7)
	Future model development	Improved growth model	Size at age/length frequencies	Wild populations Casita programme (Proposed)	Sub-sampling by S.O. NS	Ad hoc	SS	Y	Ninnes & Medley (1995, Annex 7) No documentation
		Improved estimates of F and M		Casita/tagging programme (Proposed)	NS	NS	-	N	Ninnes & Medley (1995, Annex 7) No documentation

Table XX Summary of the existing and potential sources of data and data collection methodology for finfish management. DB- Database, SS- Spreadsheet

General Objectives		Fishery	Data collected	Current / Proposed Sources of Data	Current / Proposed Data Collection Tools	Frequency	Entered (DB or SS)	Include in FIMS? (Y/N)	Comments
Maximise sustainable economic and social benefits.	Existing Situation	Commercial (general)	Total annual catch	Daily Landings by boat at processing plants Hotels/Restaurants (Proposed)	Landings sheets submitted by processors Purchase Slips (Proposed)	Monthly	DB& SS	Y	see example landing sheets
			Total annual effort	Daily number of boats (and number of fishermen) landing at processing plants Hotels/Restaurants (Proposed)	Landings sheets submitted by processors Purchase Slips (Proposed)	Monthly	DB &SS	Y	Effort to be refined with SAM data? Where is SAM data held / reports?
			Fishing cost per boat day	Socio-economic study	-	-	-	N	Any reports? Use of SAM data? See Ninnes & Medley (1995, Annex 13)
			Unit price of fish at landing site	Landings sheets submitted by processors	Landings sheets submitted by processors	Monthly	DB & SS	Y	see example landing sheets
				Processing plants (Proposed)	Price form completed by C.O.'s (Proposed)	Monthly	-	Y	See Medley (1996, p26) recording sheet: "datsheet.wb1"
			Fork length,/catch location	Landings at processing plants (5 boat sub-sample from each processor)	Biological sampling form completed by C.O.'s (proposed)	Monthly	-	Y	See Medley (1996, p27) recording sheet: "datsheet.wb1"
	Future	Deepwater Demersal	Fishing effort , locations, species composition, size and weight data	Hotels/Restaurants (Proposed)	Purchase Slips (Proposed)	?	?	Y	Only if fishing effort increases significantly Ninnes & Medley (1995, p 29)
		Near Shore Pelagic Sport	Catch, effort, size frequency	Fishermen (Proposed)	Logbooks - licence condition? (Proposed)	?	?	N	Ninnes & Medley (1995, p 31). Eventually be included
		Bonefish	Frame survey of fisheries	Fishery (Proposed)	Logbooks - licence condition? (Proposed)	-	-	N	Ninnes & Medley (1995, p 32) Eventually be included
		Offshore Pelagic	Catch and effort data	Fishermen (Proposed)	Logbooks - licence condition? (Proposed)	-		N	Ninnes & Medley (1995, p 33) Eventually be included

Table XX Reporting and administrative data and information requirements and sources

Purpose	Required Data/ Information	Format	Data source/Collection Methodology
Licence management	Licence register	as existing	Existing license database table, generated from licence application forms
	Licences due for renewal	Tabular (monthly)	Existing license database table, generated from licence application forms
	Revenue generated by licence type and island	Tabular (annual)	Existing license database table, generated from licence application forms
Annual Reports, Statistical Year Book, FAO, ICCAT reporting responsibilities	Total catches, effort, CPUE and value for each species by processing plant, and for whole fishery for fishing season and for calender year	Summary tables and time series graphs	see Tables XX - XX above
	Total exports of species by weight, value and destination	Summary tables and time series graphs	(Export records) X (current market price) (see above)
	Duties paid on exports	Summary tables and time series graphs	(Export records) X (duty per unit weight) (see above)
	Total revenue generated from fishery	Summary tables and time series graphs	(Fishermen and vessel licensing (fee) records) + (duties on exports)
Conch Quota Management	Remaining conch quota	Tabular (monthly)	see Tables XX - XX above
CITES reporting responsibilities	Total exports of conch by weight, value and destination by fishing season and calender year	Summary tables and time series graphs	(Export records) X (duty per unit weight) (see above)
Socio-economic data generation	Numbers of licensed fishermen	Summary tables and time series graphs	Existing license database table, generated from licence application forms
	Processing plant prices by species	Summary tables and time series graphs (annual amd monthly)	Landing sheets, processing plant monitoring (see above)
General	Fishing effort by fishing location	Pie charts (annual)	see Tables XX - XX above
Co-management	see below RL & NF		

Export records giving the quantity exported by tail weight category (See Annex XX), have in the past, provided an important source of information on the size structure of the lobster population. Data are available in spreadsheet format from 1973-1996. These data and total exports by weight and species should be included in the FIMS.

Length and weight frequency data for lobster has also been sampled from the Caicos Bank between 1968-1994. Morphometric and sexual maturity data has been sampled for conch ad hoc between 1990-93 and recorded in spreadsheet format. These data should also be included in the FIMS.

Some socioeconomic data has also been used in the past for estimating fishing costs. However, except for some data on fish consumption sampled in 1992, no data or any supporting documentation was available at the DECR. It was decided that this data should not be included in the FIMS until more documentation becomes available.

The casita programme has been identified as a important source of data to refine the existing management models (Ninnes & Medley, 1995). However, the programme activities have been sporadic and poorly documented, and it appears that no formal or routine data collection and recording systems exist (DECR per comms).

The SAM programme is believed to be an important source of information to refine indices of conch and lobster abundance (Ninnes & Medley, 1995). However, the programme appears to have suffered the same neglect as the casita programme and virtually no data or documentation are available.

A major issue which arose at the workshop was whether the existing data collection systems should be extended to include catches landed for destinations other than the processing plants, identified in the disposition pathway diagrams (see above). The pathways indicated that monitoring landings for hotels, restaurants and supermarkets, perhaps using some form of purchase slip, could significantly improve the existing data coverage with little additional effort or resources.

Administration and Reporting Responsibilities

Data and information requirements for administration and reporting responsibilities are derived from landing sheets (see above), fishermen and vessel licensing records (generated from application forms), and export and customs forms (submitted by the processor) (Table XX). Presently, export records are not entered onto the Department's database and manual intervention is required to produce the majority of the required outputs.

Community feedback/Reporting

RL&NF

5.1.2 The Existing Database

The DECR's existing database is written in DataEase 4.5, an old MS DOS program. Neither the computer on which the database is placed nor the software itself are year 2000 compliant. This database forms the foundation of the fisheries management system of the DECR and comprises three main tables: a catch and effort table, a fishermen and vessel licensing table, and a landing price table. The database is relational between the catch and effort, and licensing table; the key identifier being

fishermen surname.

The main catch and effort table contains the following fields arranged as columns: year, month, processing plant identification code, species code, fishermen identification number, first name, surname, vessel crew size, fishing method, price paid for catch per lb, total catch for the month, numbers of days fisherd, data recorded daily (y/n), total catch on each day (day 1-31). Each row contains the catch and effort details for a fishermen (surname) for a one month period.

The licensing table contains the following fields (columns): fisherman identification number, fisherman surname, first name, nickname, nationality, file reference number, island where licence was issued, licence renewed (y/n), licence tyep code, date issued, date expired, licence fee (fishing), receipt number, fishing method, vessel name, vessel length, engine HP, GRT, colour, vessel licence type code, date issed, date expired, licence fee (vessel), receipt number.

The landing price date contains the following fields: Processing plant identification code, name, species code, species name, fishing method, start date and price per lb.

Data is entered and edited using three forms. Basic reports can be produced summarising the catch and effort data recorded for each processing plant (and for all plants combined), and vessel and fishing and vessel licensing data by island and licence type (Annex XX).

Catch and effort data recorded prior to 1989 is stored in spreadsheet format. A number of other spreadsheet files contain lobster export tail weight, and length frequency data sampled from the Caicos Bank (Tables XX-XX).

****

RL & NF

5.2 Community Objectives, Data and Information Requirements

willingness to participate in data collection systems?

****

5.4 Cost Evaluation

Cost evaluation will be addressed after the prototype system has been developed.

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Acknowledgements

Annex 1

Fieldwork Itinerary (A.S.Halls) - Roger and Nikola - please complete your table below

Date	Activities
17/05/99	Depart Gatwick 10.10 Arrive Provodenciales 19.30 Overnight at the Turtle Cove Hotel
18/05/99	Depart Provodenciales 07.30 Arrive S.Caicos 08.30 Taxi to Ocean Haven Hotel Meeting with RL and NF Meeting with Wesley Clovel (Fisheries Officer - South Caicos)
19/05/99	Literature review Meeting with Christy Hall
20/05/99	Meeting with Andrew xxxx Director, School for Field Studies, South Caicos. Literature Review
21/05/99	Meeting with Michelle Fulford and Linda Grinton (database clerk) (DECR) Grand Turk. Meeting with Terrance Smith (Permenant Secretary, Ministry for Natural Resources. Literature Review
22/05/99	Literature Review
23/05/99	Literature Review
24/05/99	Depart S.Caicos / Arrive Grand Turk Review of available data/literature
25/05/99	Survey of landing sites/estimation of vessels/fishermen numbers Literature Review
26/05/99	Examination of existing FIMS
27/05/99	Literature Review
28/05/99	Literature Review
29/05/99	Literature Review
30/05/99	Literature Review
31/05/99	Literature Review
01/06/99	Workshop preparation with Michelle Fulford

02/06/99	Workshop preparation and literature review
03/06/99	Workshop with DECR staff to finalise design and requirements of FIMS
04/06/99	Workshop with DECR staff to finalise design and requirements of FIMS
05/06/99	Report write up
06/06/99	Report write up
07/06/99	Depart Grand Turk
08/06/99	Arrive LHR

Fieldwork Itinerary (Roger and Nikola - please complete your table below)

Date	Activities

Action on return to UK -

- Talk to Paul about data requirements and stock assessments eg tagging etc to estimate growth and mortality etc (Project Proposals??).

Annex 2

Annex 3

Information Systems for the Co-Management of Artisanal Fisheries

Meeting/Workshop

Project Objectives:	To enable better management and appropriate development of artisanal fisheries, by developing and testing a generic fisheries information management system (FIMS) suitable for significantly different situations.
Meeting/Workshop Purpose:	To obtain further information required to develop a more effective FIMS to serve the needs of the DECR and the wider fishing community.
Venue:	DECR Conference Room
Proposed Date:	Thursday June 3rd - Friday June 4th
Persons who should attend:	Christy Hall, Michelle Fulford, Wesley Clerveaux, John Ewing, Piere Seymour, Eldon Talbot, Roger Lewins, Ashley Halls, Linda.

Meeting Agenda:

Thursday (Christy Hall, Wesley Clerveaux, Piere Seymour, Eldon Talbot, Roger Lewins, Ashley Halls)

- Construct maps of major fishing areas for conch, lobster and finfish
- Construct maps of landing sites for each island including details of numbers of boats/landing frequencies/facilities etc
- Discuss accuracy of disposition pathways for lobster, conch and finfish.

Friday (Christy Hall, Michelle Fulford, Wesley Clerveaux, Ashley Halls, Roger Lewins, Lina Glinton).

- Discuss accuracy/uncertainties of summary tables for data collection programmes and establish what information should be included in the prototype FIMS. What is the current position of the casita programme?
- Establish the scope of the prototype FIMS - what should be included (eg casita project), should it be extended to include catches not landed at processors, which islands should be included, additional sampling?
- What are the existing feedback mechanisms and pathways, and what is desired eg (reports, table, summaries, graphs etc). What about community feedback?

Additional Information Sought
Do all processors record finfish landings?

Is their any documentation for the Socio-economic studies/ consumption surveys undertaken as part of the Fisheries Mangement and Development Programme (1989-1995)?
Export data (values) for the last five years (Linda)
How are finfish processed, where does it go?
Figures for the proposed lobster zones referred to in the Management Plan.
Copies of all data collection forms, including export records
Unit costs for running existing FIMS eg costs of data collection, data entry, fuel costs, administration etc.
Photocopies of all relevant reports/papers
Copies of all spreadsheet databases

Attached: Disposition Figures
Data collection Tables

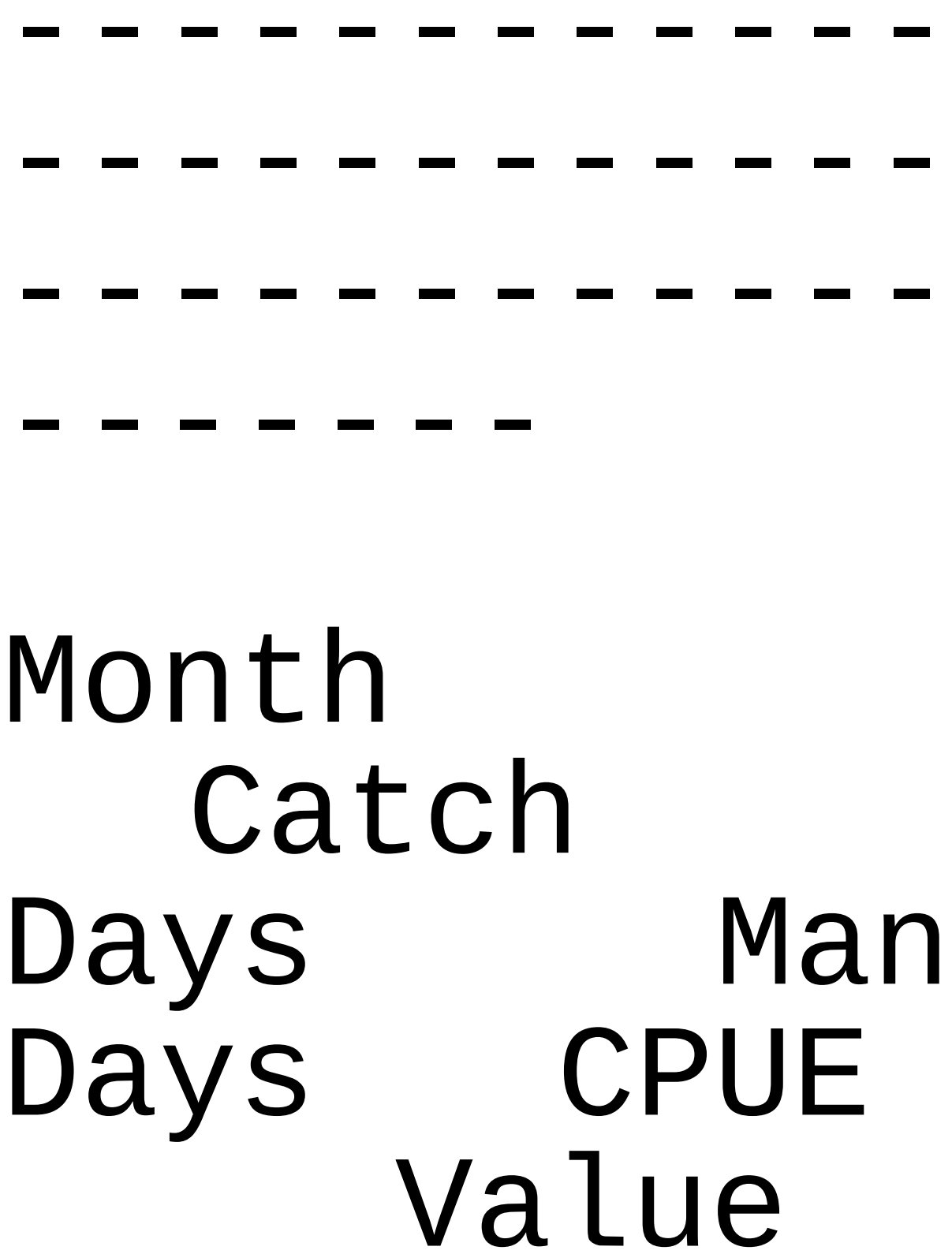
Table XX Example Output from the DECR database

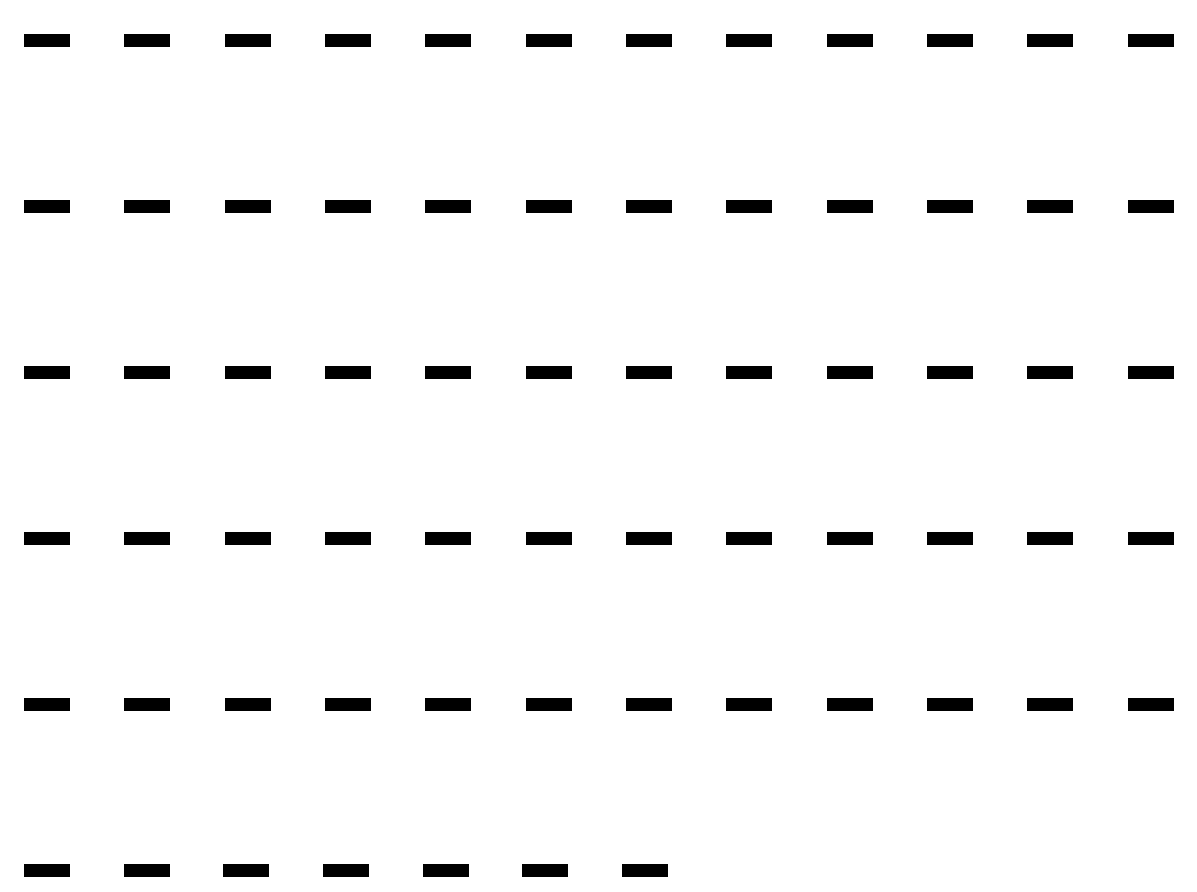
TURKS AND CAICOS ISLANDS: **TOTAL MONTH LANDINGS** dated

18/06/99

97 Season

LOBSTER


Month
Catch
Days
Man
Days
CPUE
Value



08
181367.0
963
2351.5

90.7
473557.73

09
59063.5
519
1237.0
45.6
157533.16

10

53435.5
492
1063.0
49.6
141191.45

11
42004.5
393
779.5
59.5

114534.27

12
67593.5
465
921.0
92.3
194215.05

01
38634.5

430
918.5
48.5
111261.20

02
29282.5
299
671.5
51.6
84290.40

03
35994.0
344
724.5
56.8
62896.40

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Total
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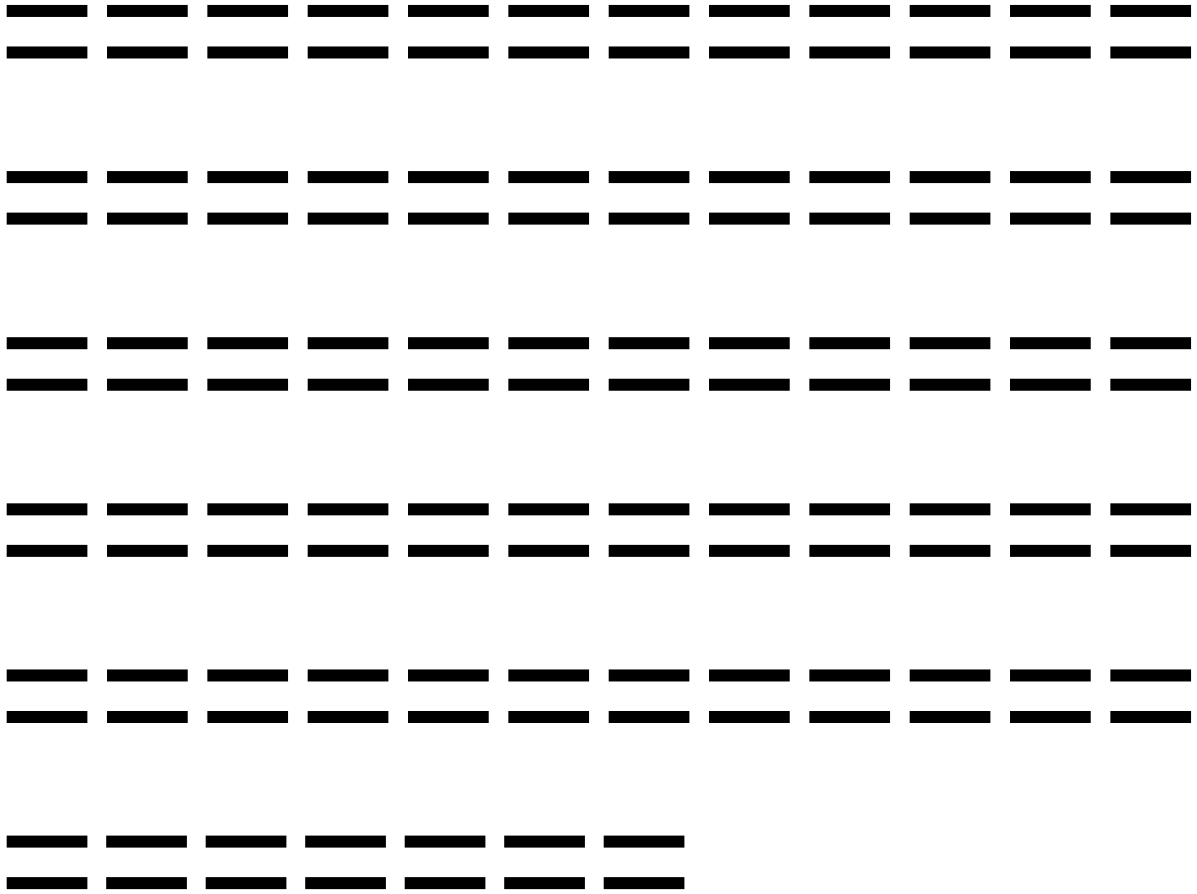
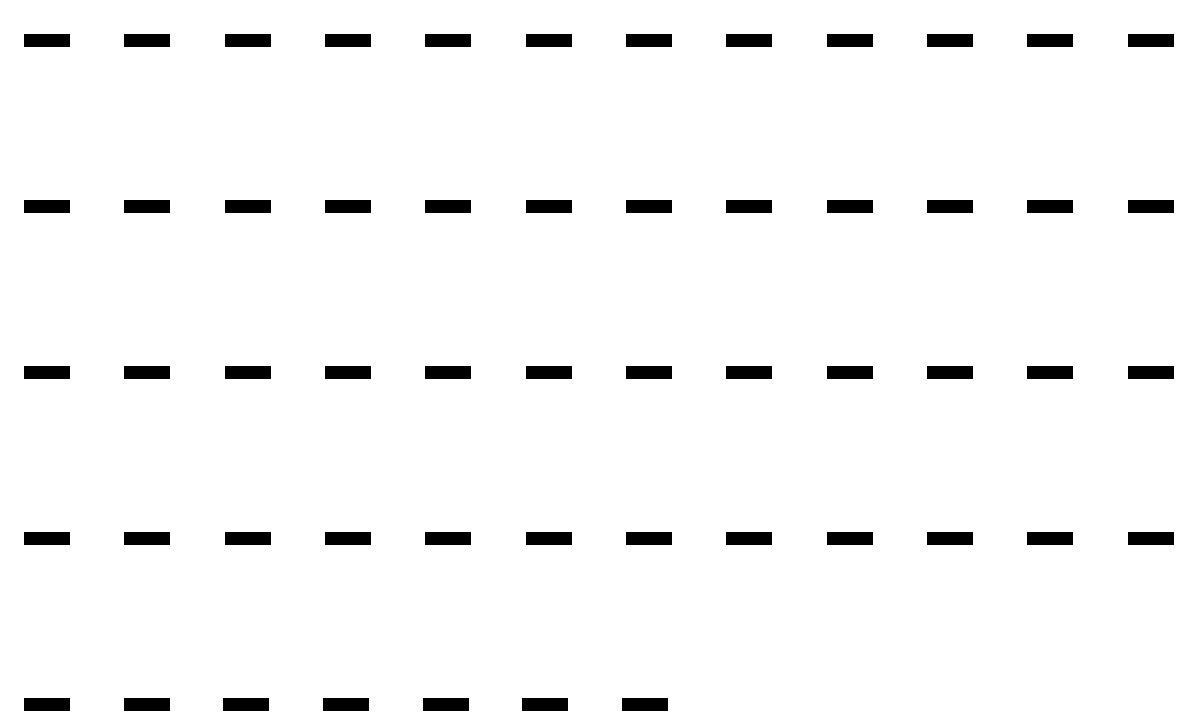
3905
8666.5
62.7
1339479.65



CONCH

Month	Catch	Man Days	Days	CPUE	Value



08
128325.0
271
638.0
221.9

89827.50

09
329387.5
637
1429.5
234.9
230571.25

10
278035.5

573
1270.0
229.6
194624.85

11
197265.5
465
866.0
283.4
138085.85

12
125859.5
319
784.5
218.7
88101.65

01
93608.0
267

583.0
180.9
65525.60

02
73973.0
229
469.0
189.5
51781.10

03
34464.0
134
313.0
152.6
24124.80

04
150274.5
398
1300.5

187.6
105192.15

05
142635.0
261
646.0
244.0
99844.50

06

95452.0
131
287.0
334.1
66816.40

07
87269.0
157
360.0
255.9

61088.30

Total
1736548.5

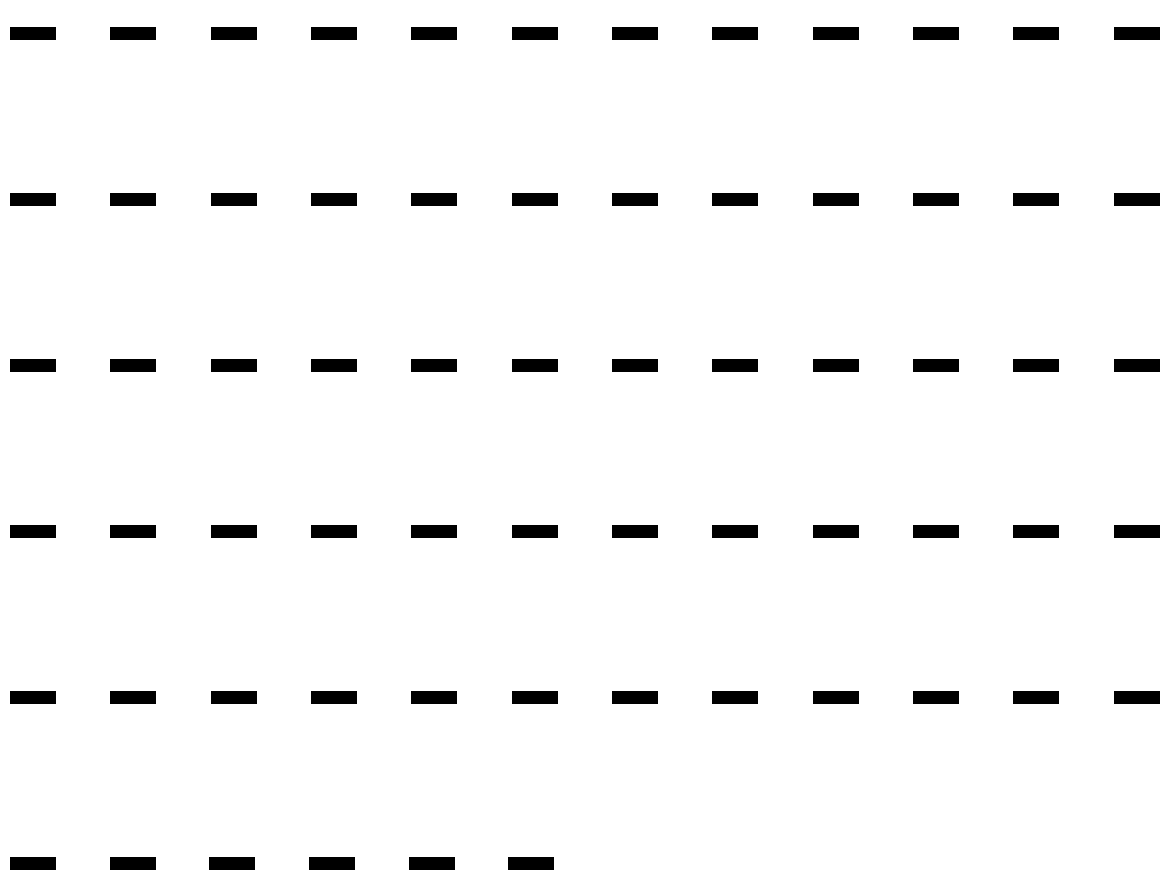
3842
8946.5
226.4
1215583.95

TURKS AND CAICOS ISLANDS: **PLANT LANDINGS** dated 18/06/99

LOBSTER

C A I C O S R O Y A L E SEAFOODS

97 Season



Month
Catch
Days Man
Days CPUE

Value

08
54160.5

289 716
75.6
138109.28

09
21792.0
179 426
51.2
55569.60

10

24756.0
205 468
53.0
63127.80

11
17031.0
128 308
55.4
43939.98

12
18476.5
181 402
46.0
49147.49

01
14878.0
165 380
39.2
41658.40

02
13372.5
120 307
43.6
37443.00

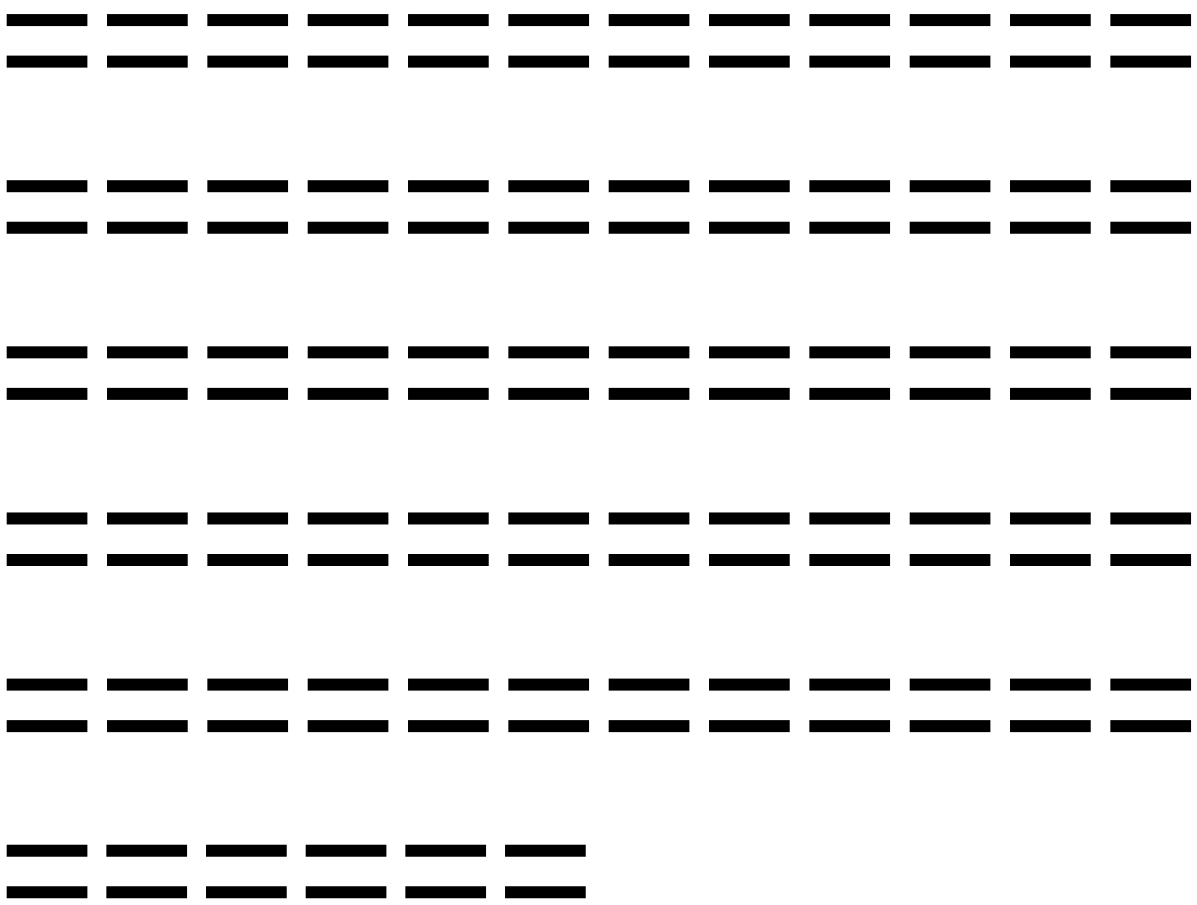
03
13584.0
127 312
43.5

38035.20

Total

178050.5

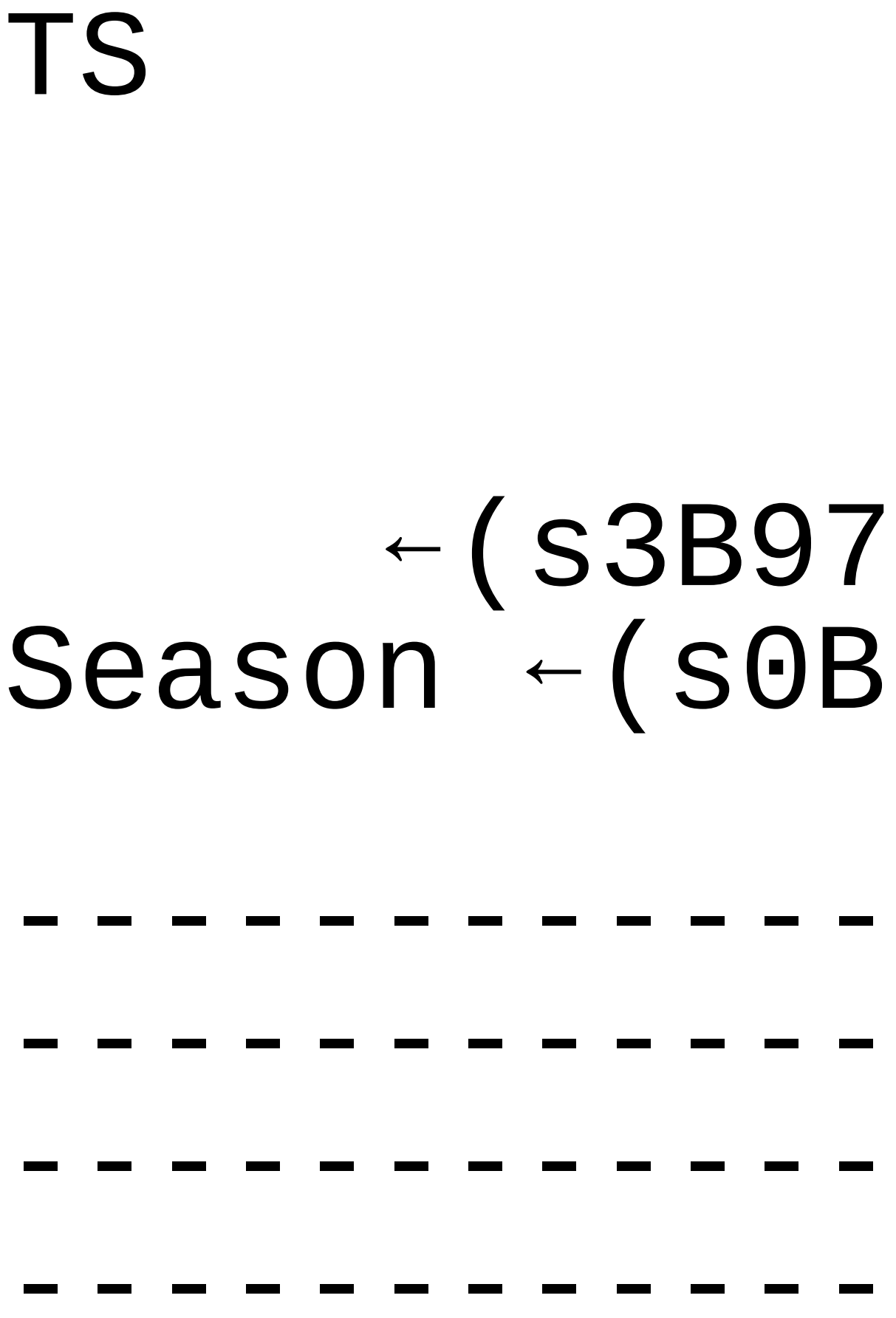
1394
3317
50.9
467030.74



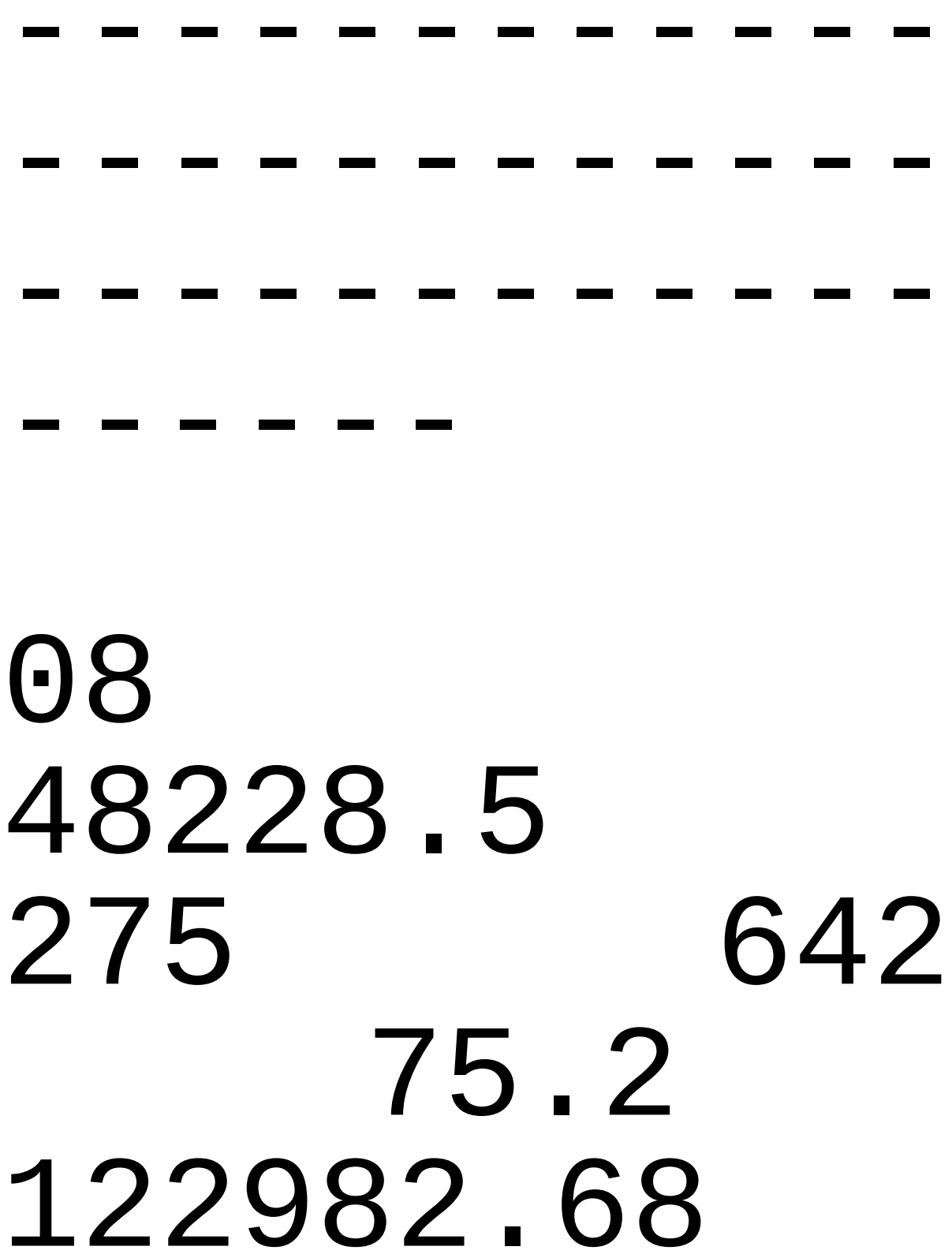
178050.5
1394

3317
50.9
467030.74

H E N S O N IMPORT/EXPOR


TS
←(s3B97
Season ←(s0B

Month
Catch
Days
Man
Days
CPUE
Value


08
48228.5
275
642
75.2
122982.68

09
11928.5
132 294
40.6
30417.68

10
12451.5
129 284
43.8
31751.33

11
10300.5
112 260
39.6
26575.29

12
6716.0
82 174
38.6

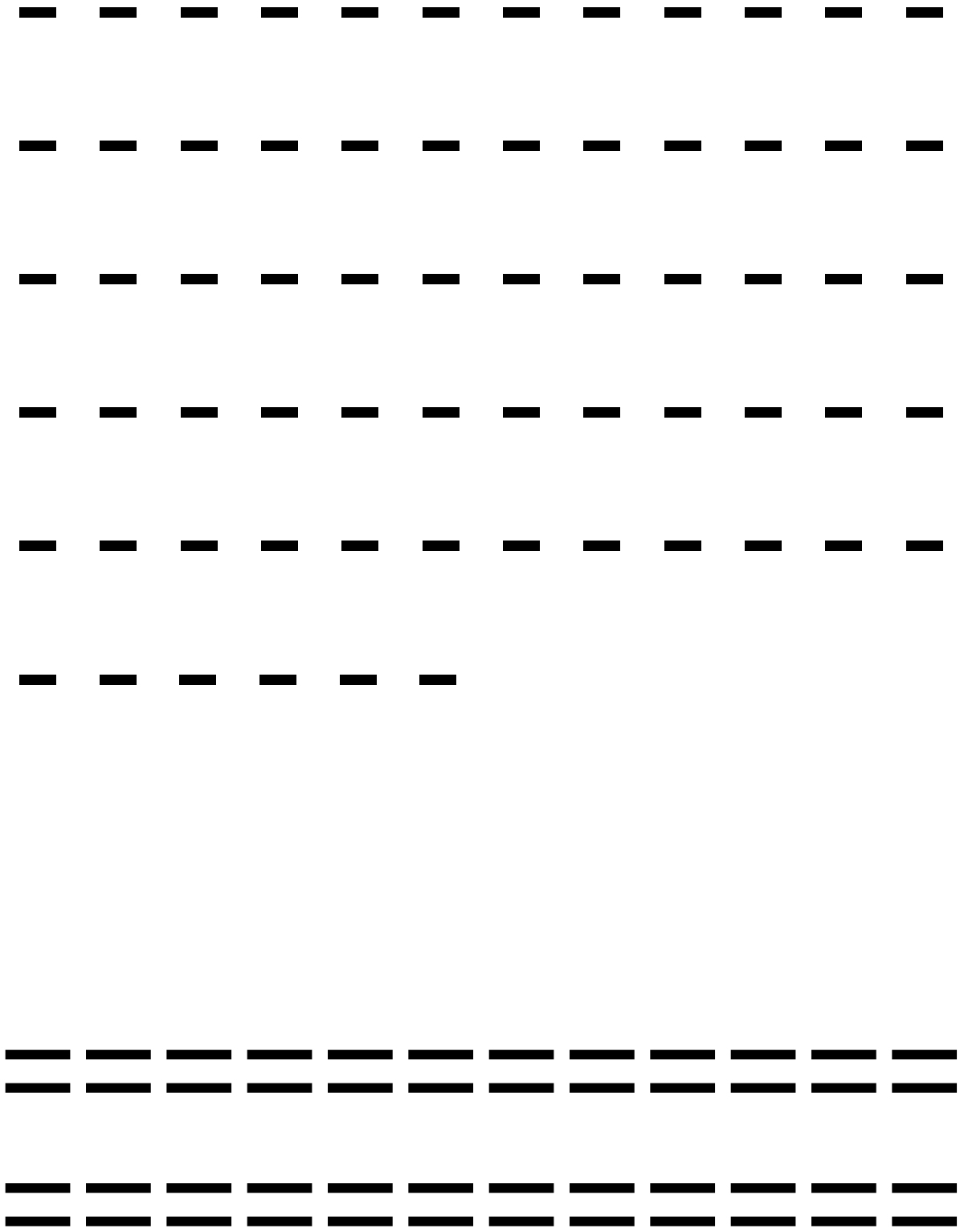
17864.56

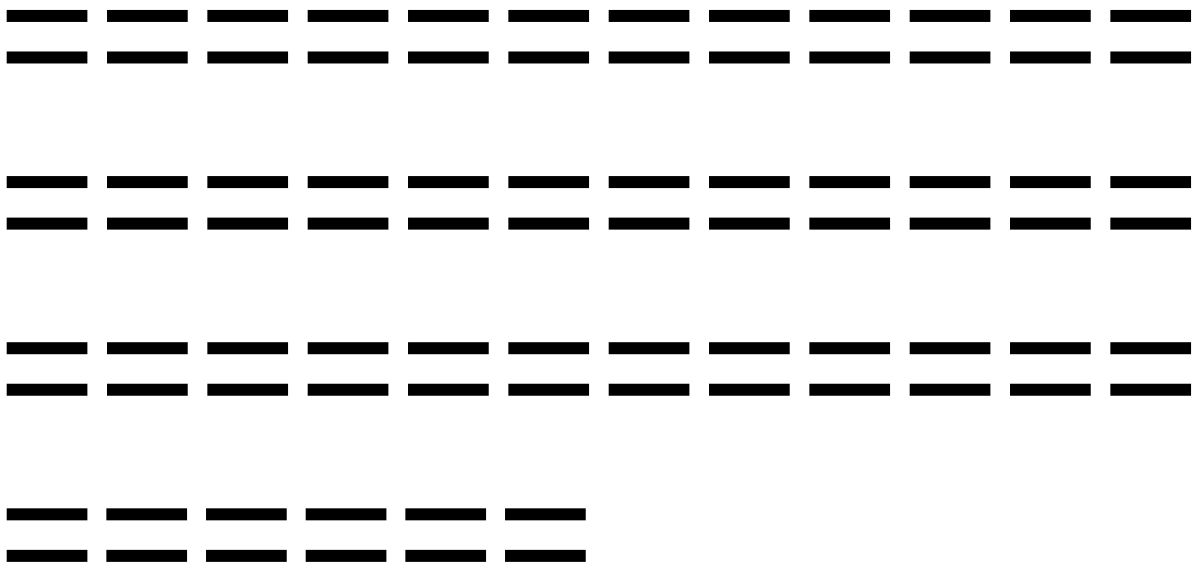
01
8333.5
107 229
36.4
23333.80

02
4413.0
70 166

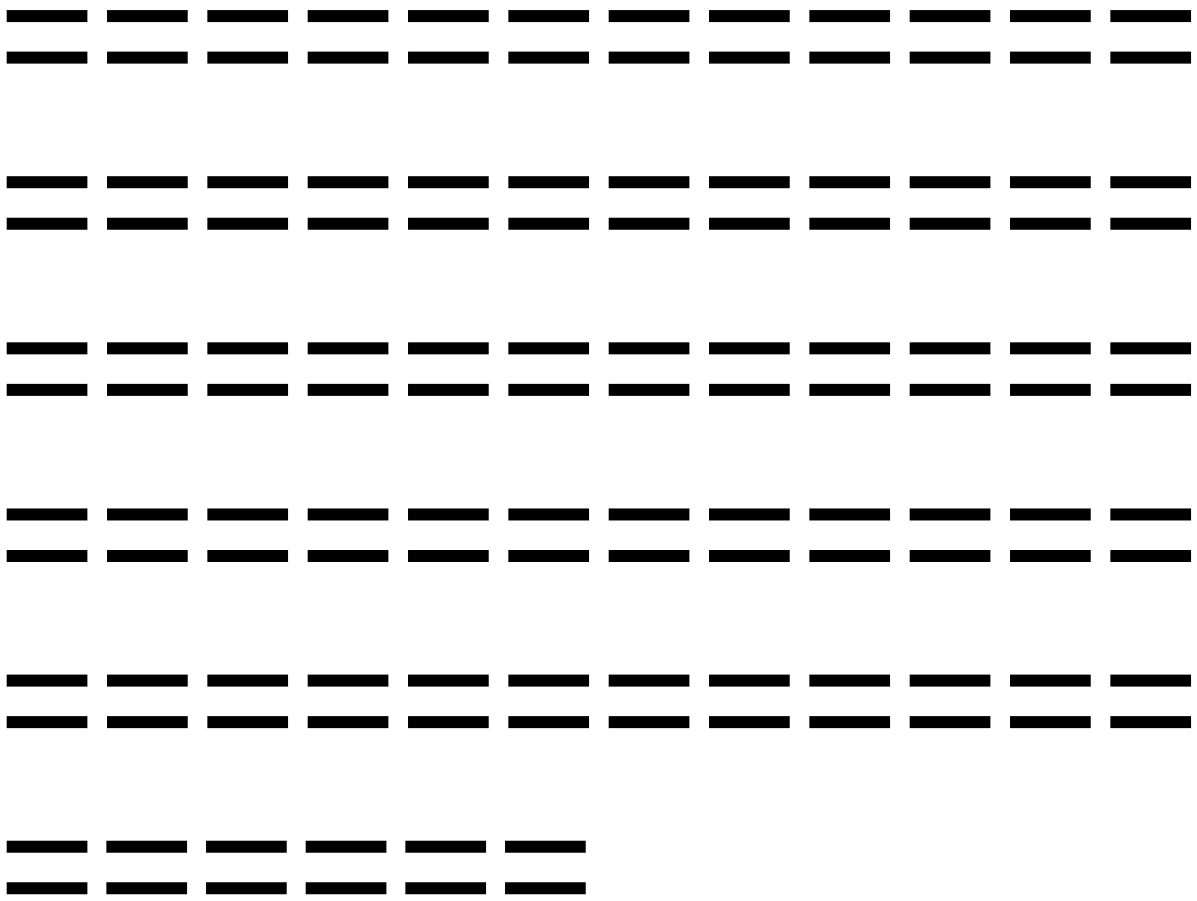
```
     26.6
12356.40

03
7344.0
102          217
     33.8
20563.20

----------
----------
```

Total
109715.5
1009
2266
41.8
285844.93

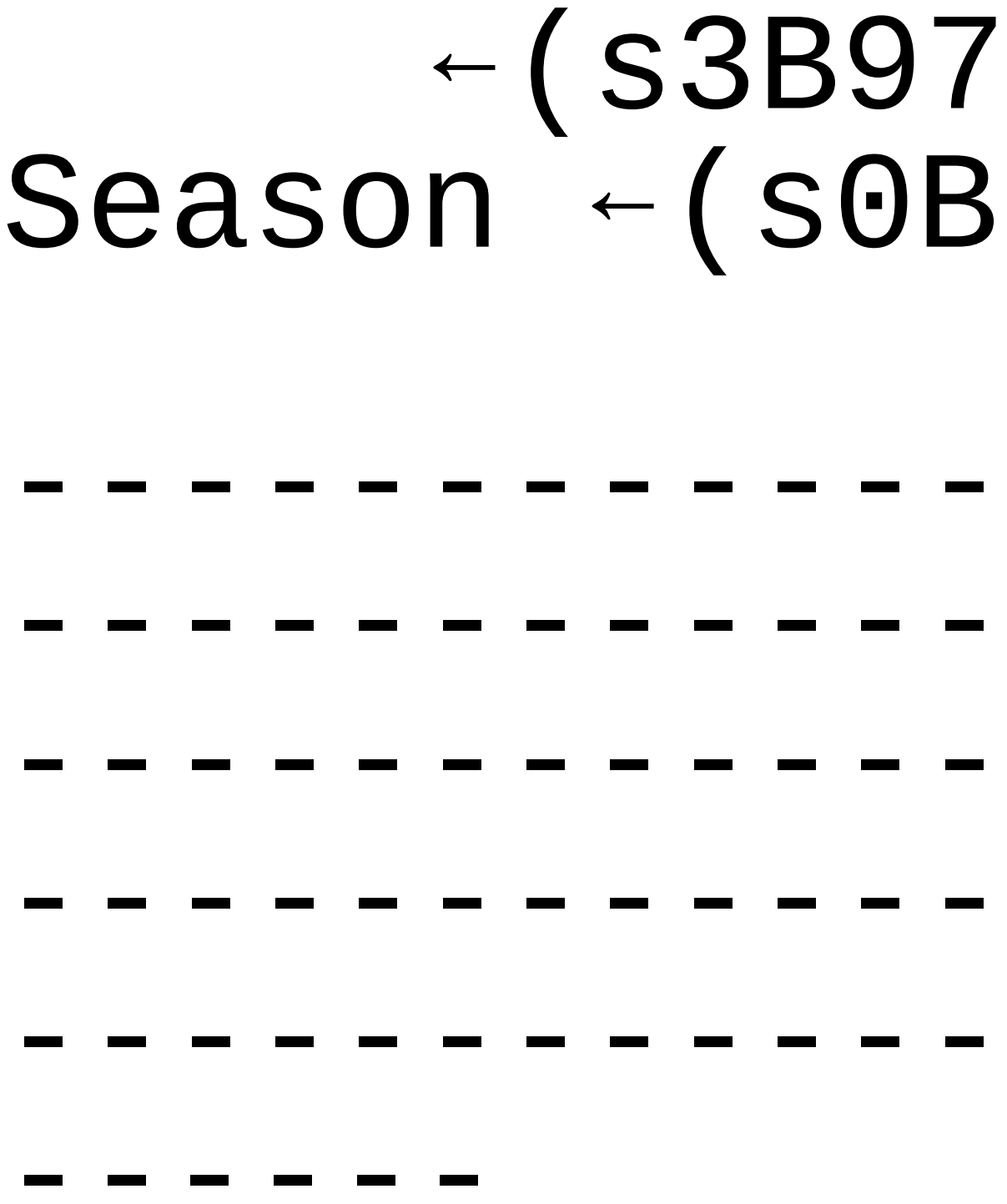




109715.5
1009
2266
41.8
285844.93



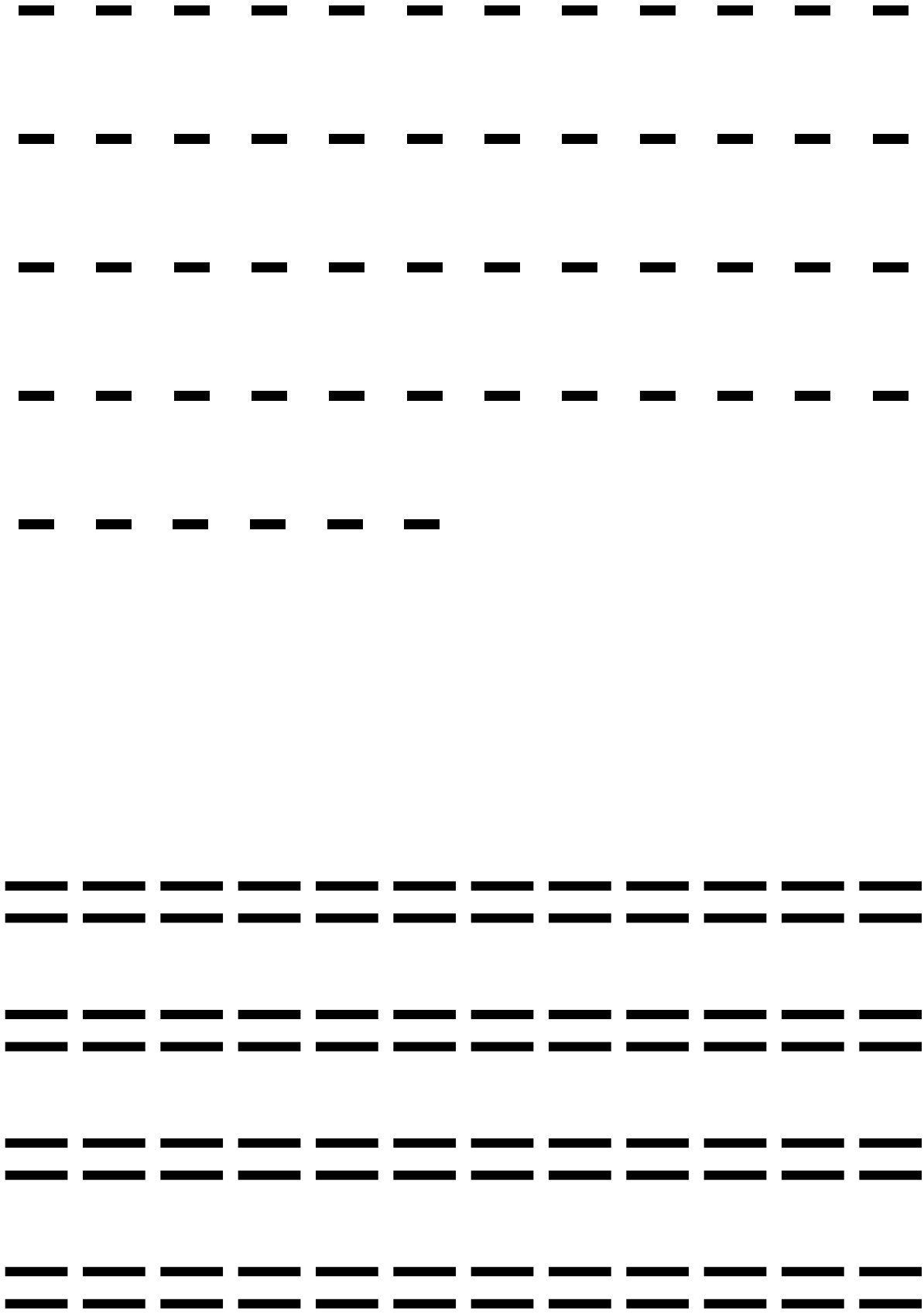
L T C Fisheries


←(s3B97
Season ←(s0B

Month	Catch	Days	Man Days	CPUE Value

```
------

08
1311.0
3                 8
  163.9
3277.50

----------
----------
----------
```


Total
1311.0
3 8
 163.9
3277.50



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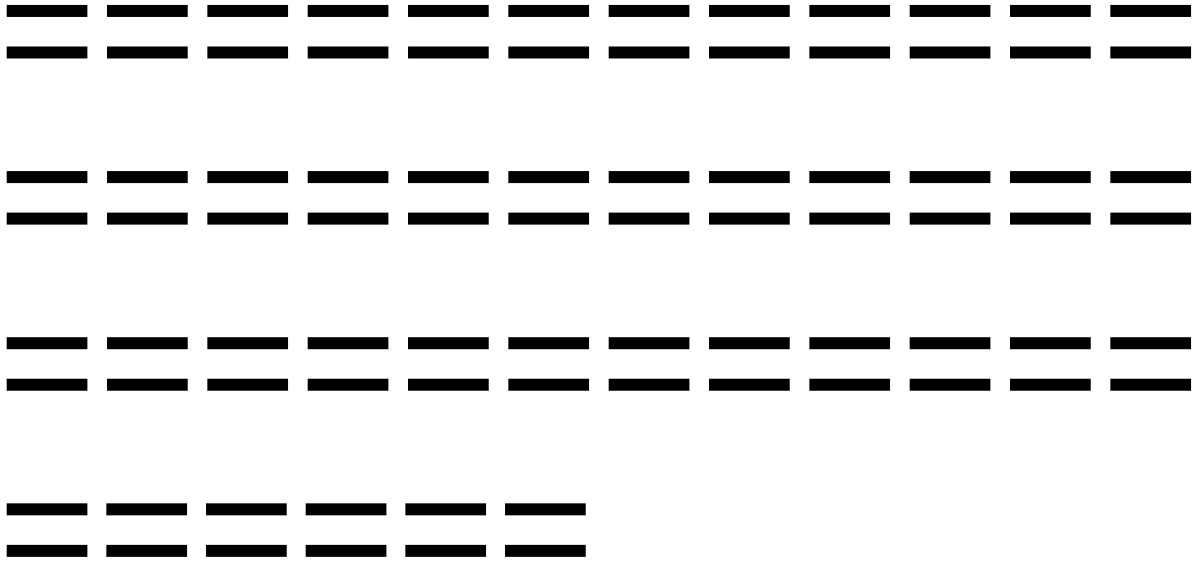
==========

1311.0
3 8
163.9
3277.50

==========

==========

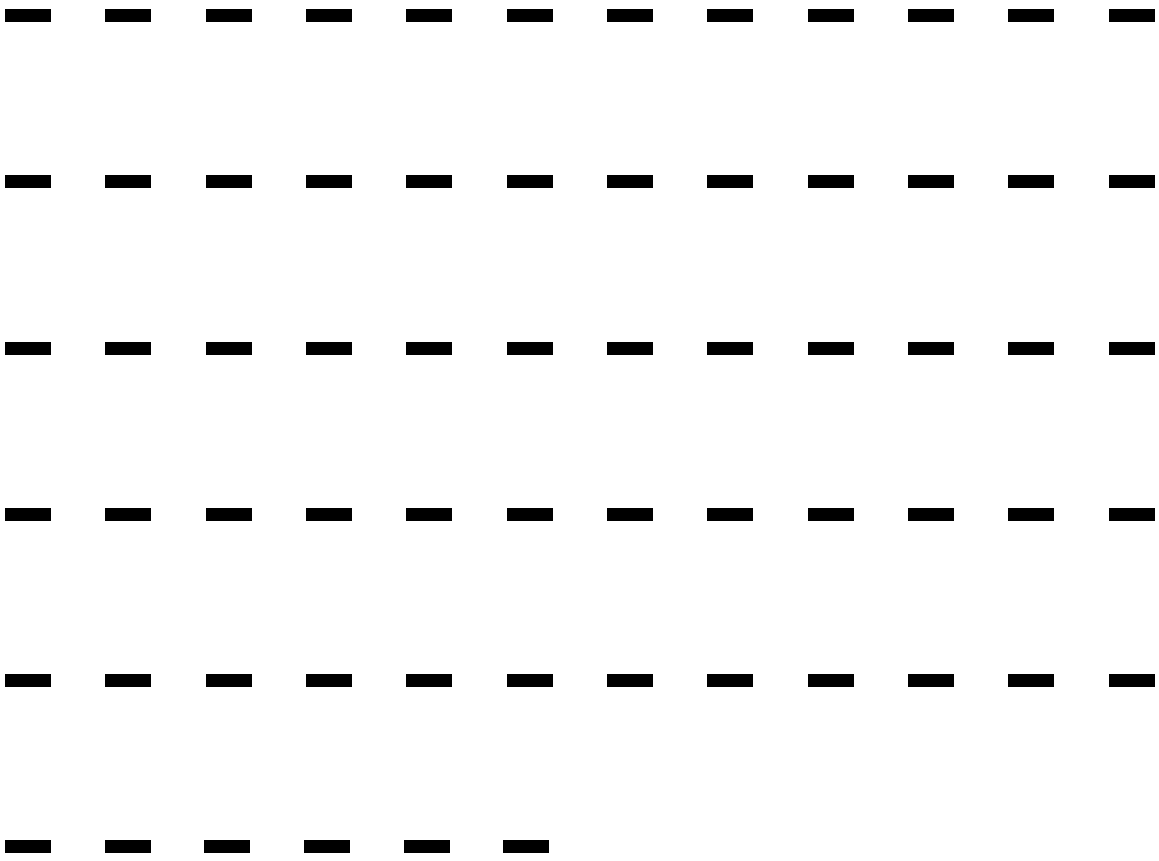


PROVO CONCH & SEAFOOD

←(s3B97
Season ←(s0B

TURKS AND CAICOS ISLANDS: PLANT LANDINGS dated 18/06/99

LOBSTER



Month	Catch	Days	Man Days	CPUE	Value

```
------

08
46329.0
189          473
      98.1
126014.88

09
13180.0
79           198
```

66.7
36245.00

10
9882.0
71 120
82.7
27274.32

11
9624.0

71 105
91.7
28872.00

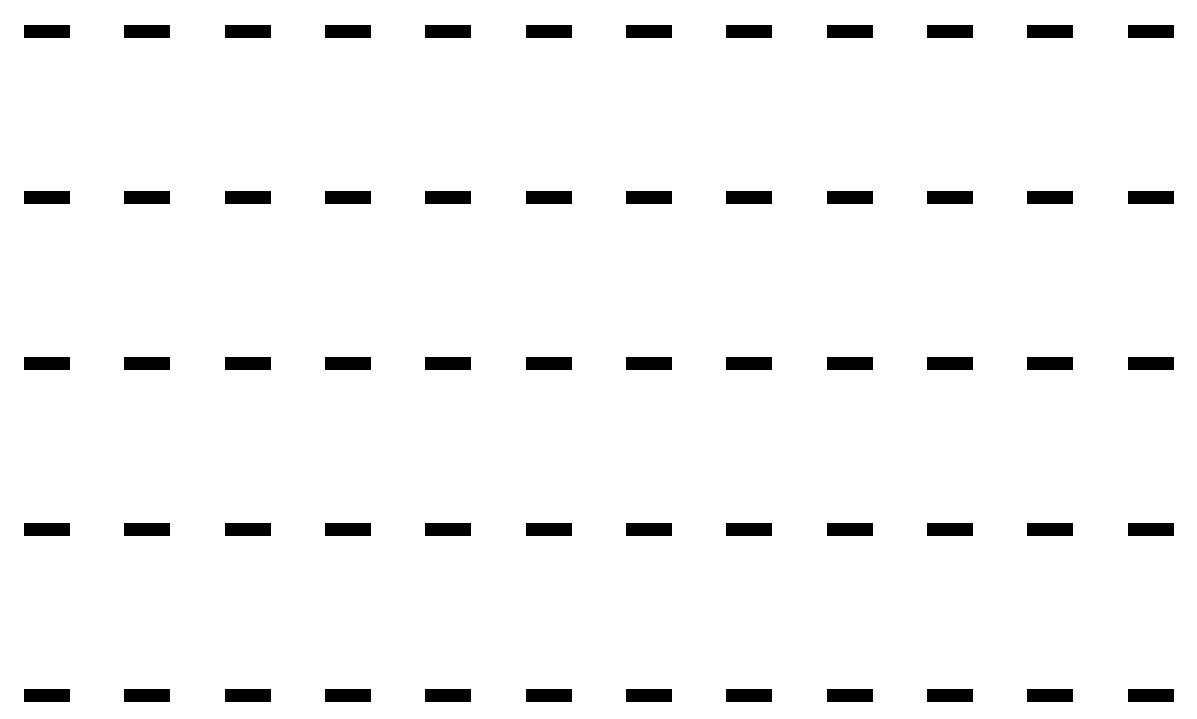
12
33319.0
91 112
298.8
99957.00

01

7306.0
62 75
98.1
21918.00

02
6436.0
45 53
121.4
19308.00

```
03
10225.0
72                110
     93.4
     0.00
```



```
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Total
136301.0
680          1243
     118.9
359589.20

----------
----------
----------
```
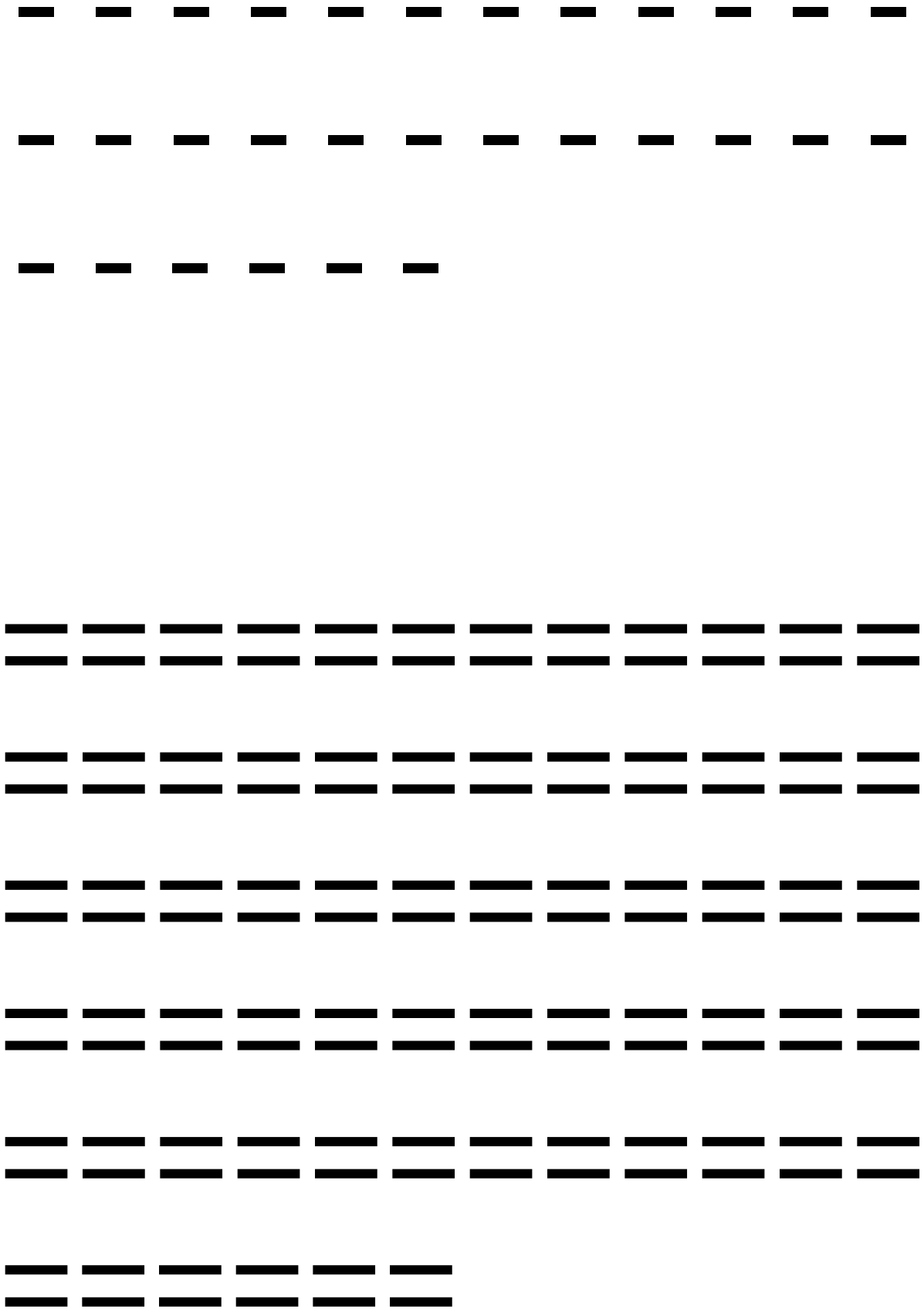
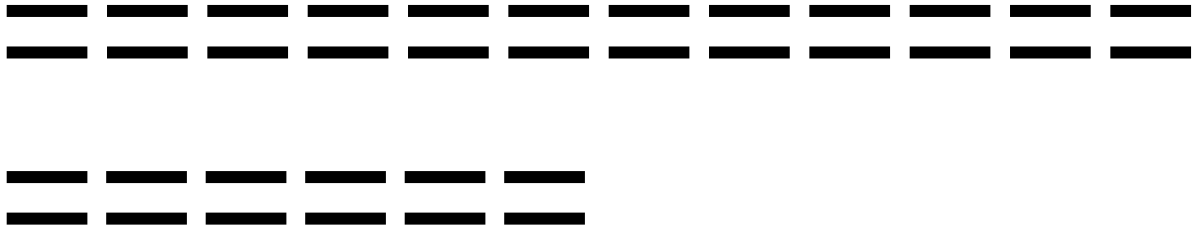



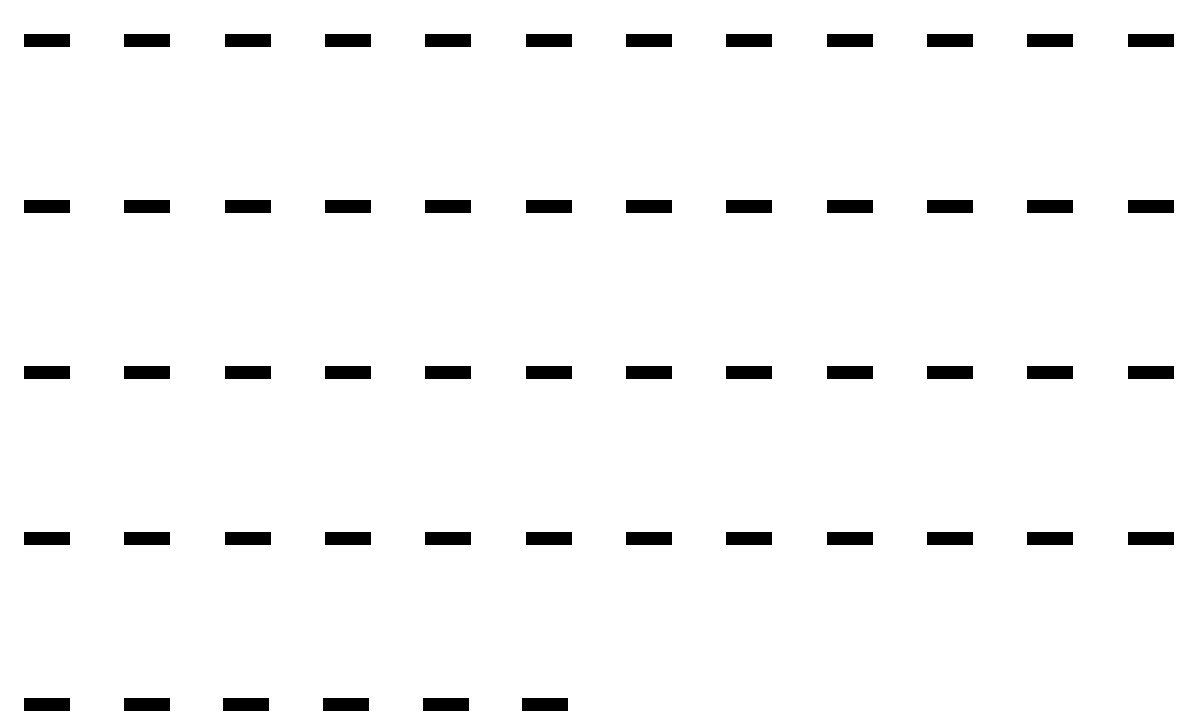
136301.0
680 1243
118.9
359589.20



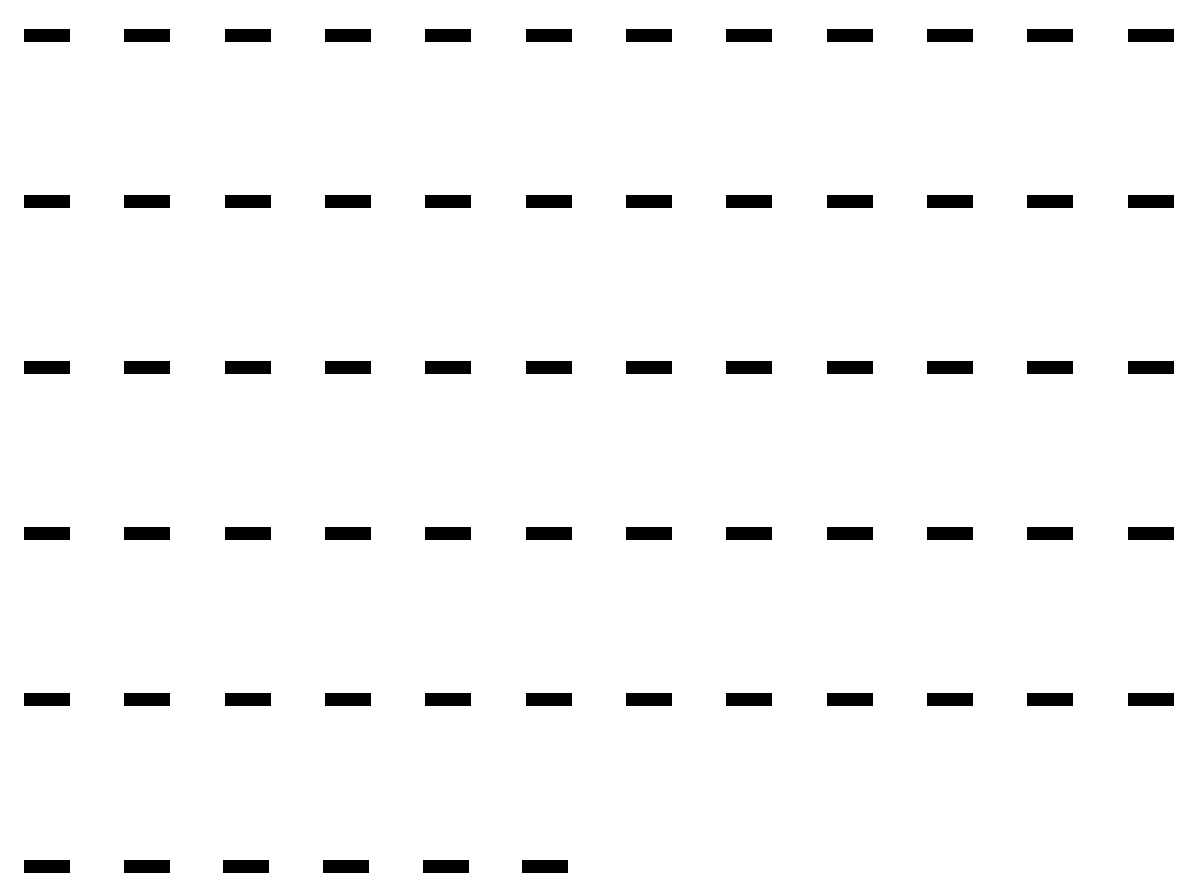
T & D SEAFOOD

←(s3B97 Season ←(s0B

- - - - - - - - - - - -



Month
Catch
Days
Man
Days
CPUE
Value



08
19267.0
129 358

53.9
48167.50

09
9901.0
98 239
41.4
28514.88

10
3402.0

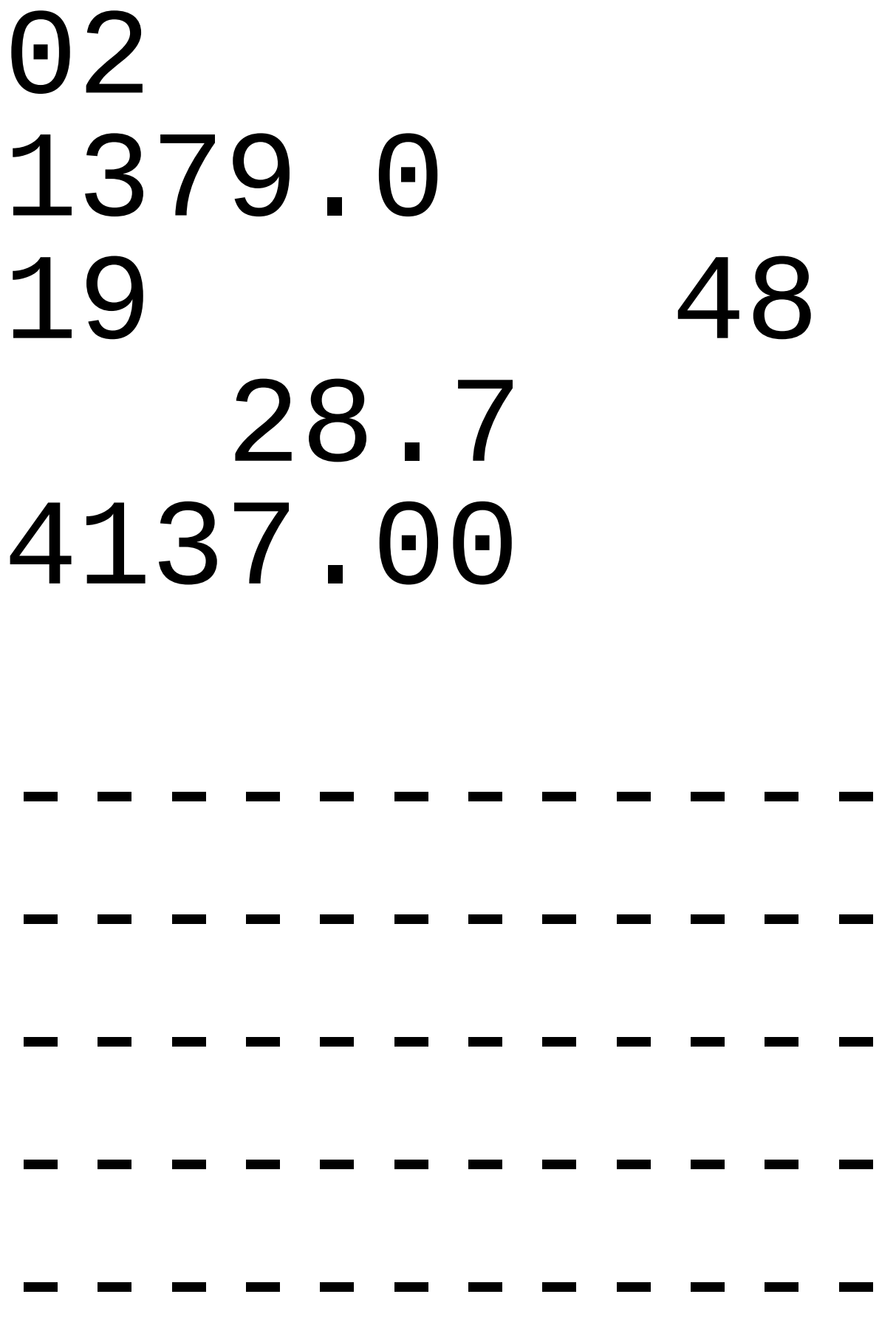
50 118
28.8
10206.00

11
2388.0
48 73
32.7
7164.00

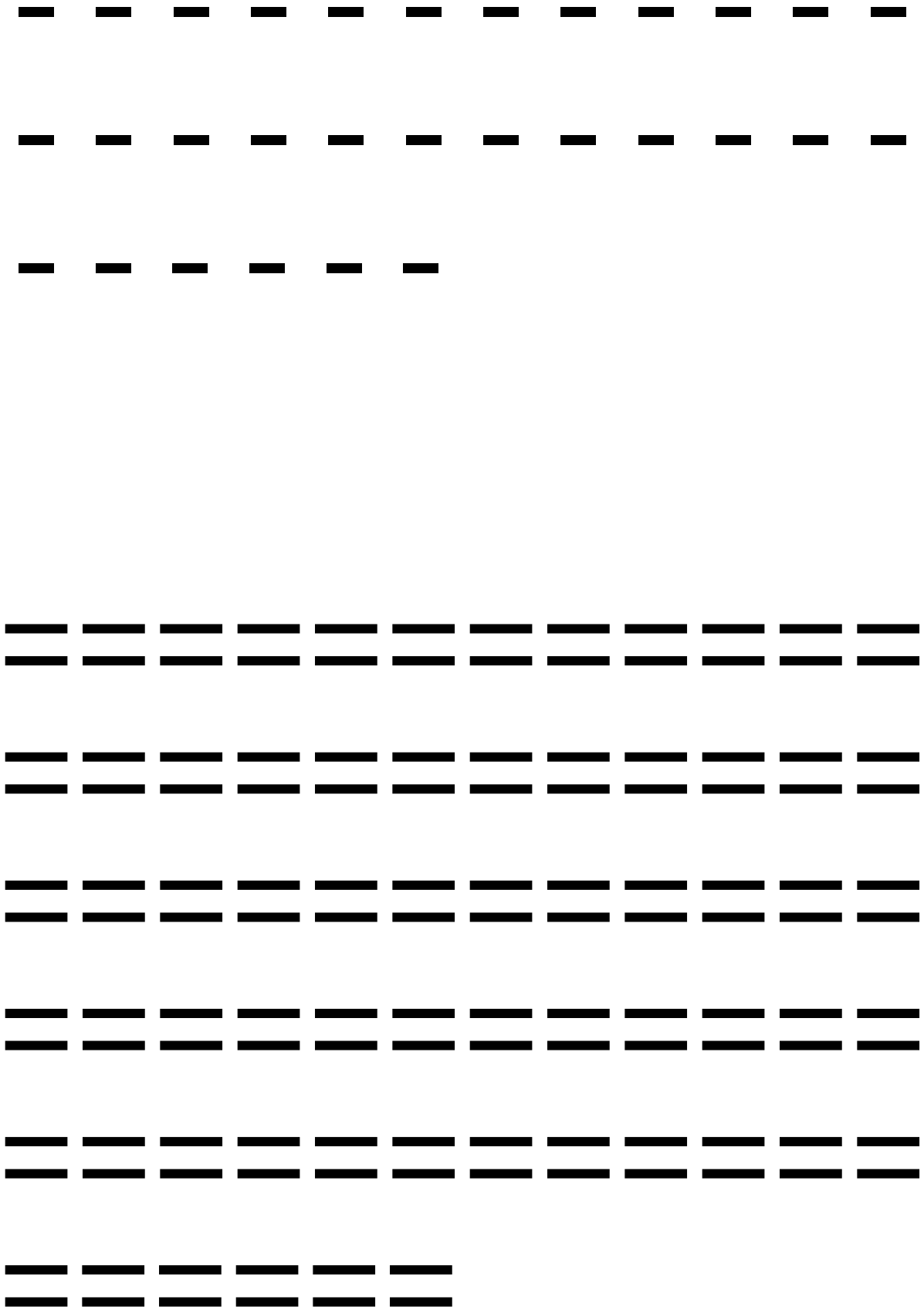
12

4405.0
48 108
40.8
13215.00

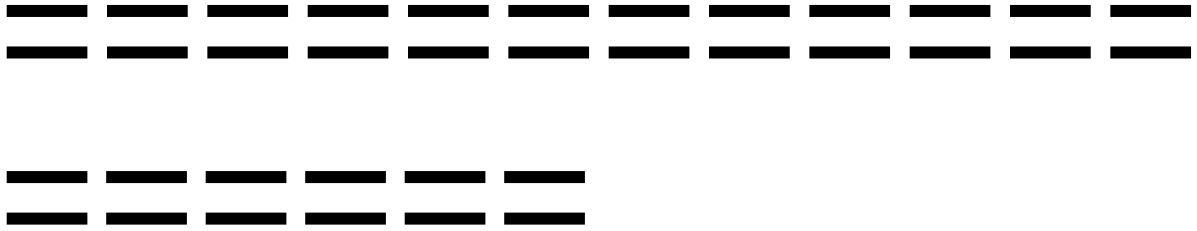
01
3004.0
35 87
34.5
9012.00


02
1379.0
19
48
28.7
4137.00

```
------

Total
43746.0
427          1031
        37.3
120416.38

----------
----------
----------
```



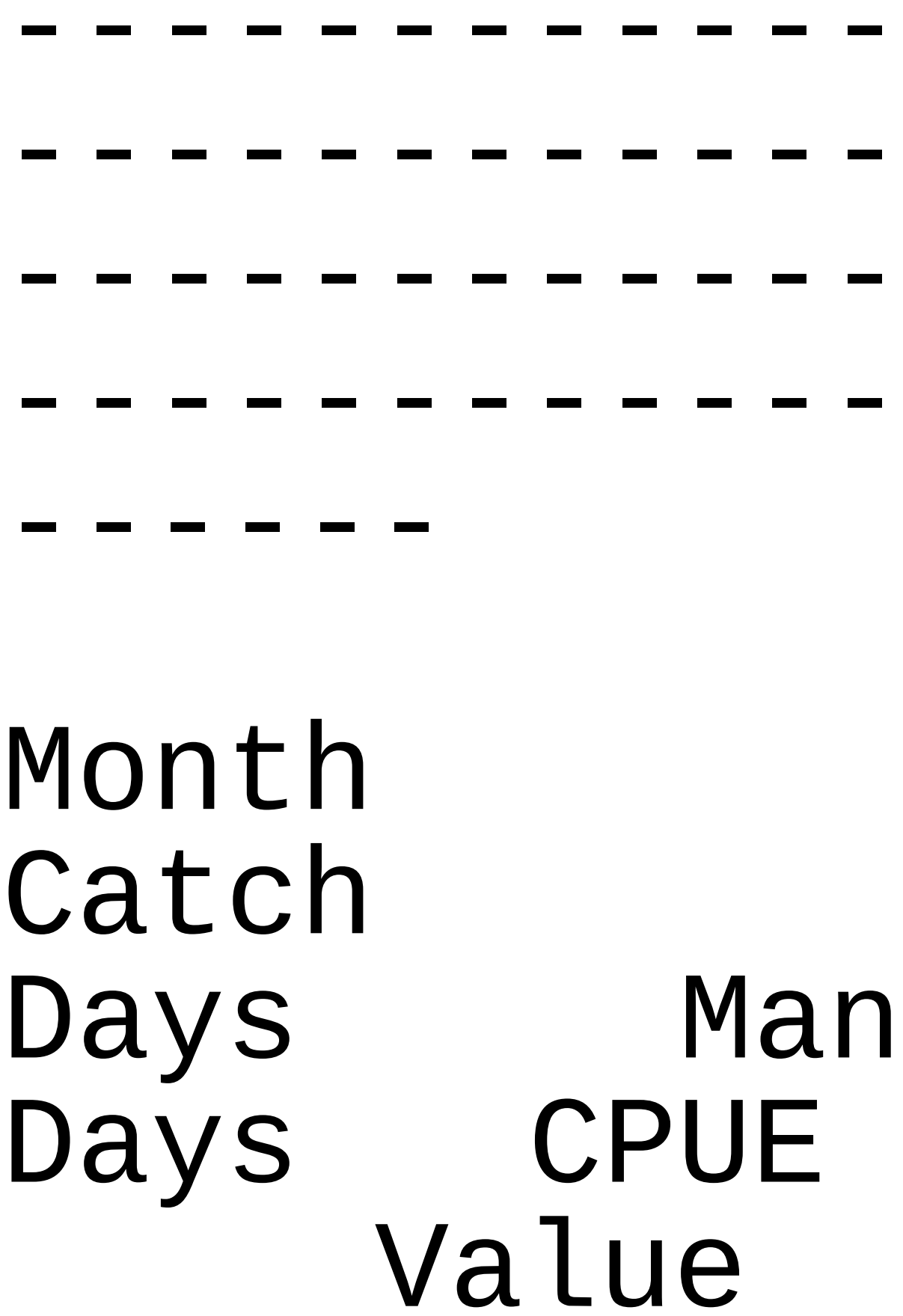
43746.0
427 1031
37.3
120416.38

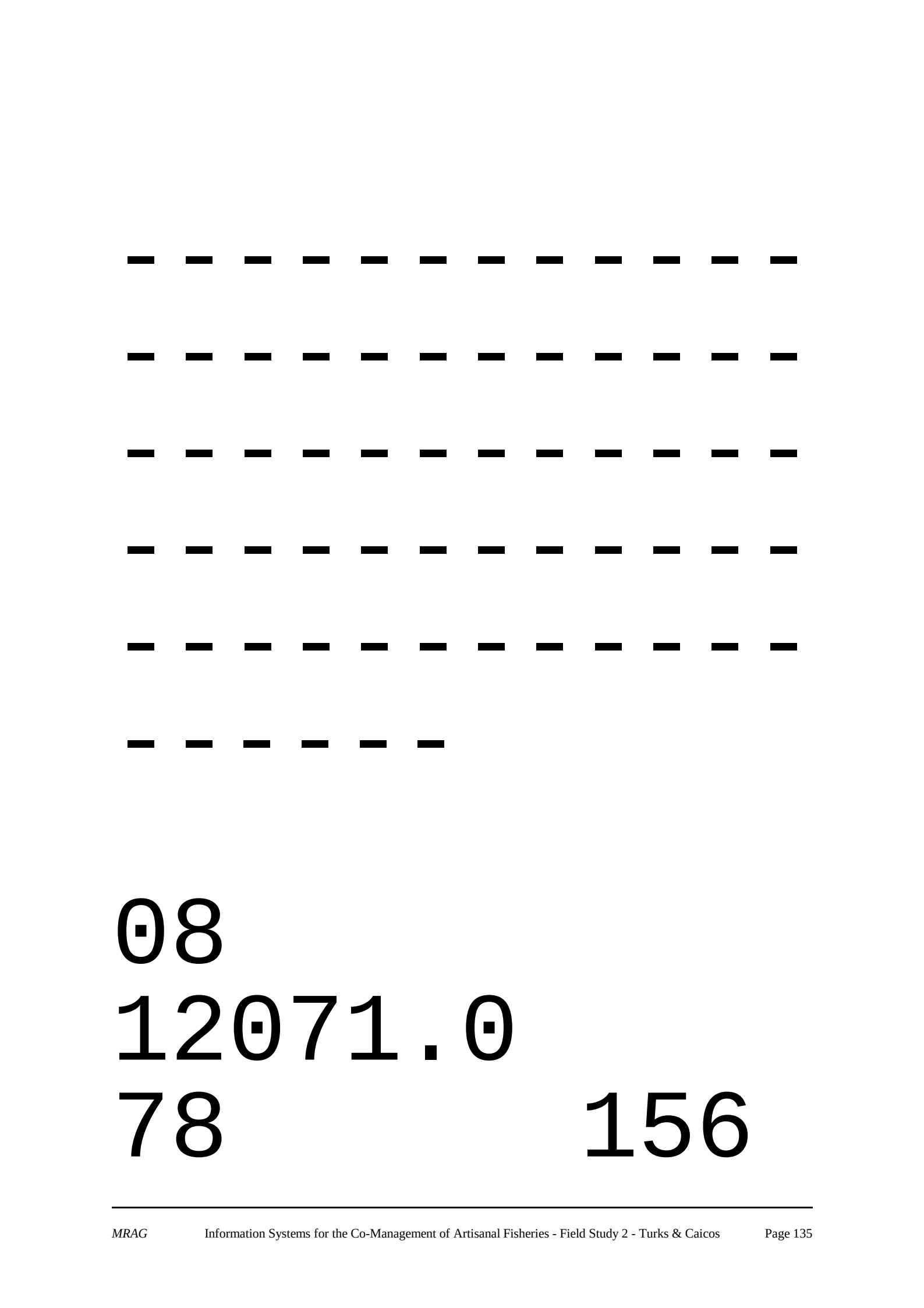


TURKS AND C A I C O S SEAFOOD

←(s3B97
Season ←(s0B

- - - - - - - - - - -


Month
Catch
Days
Man
Days
CPUE
Value


08
12071.0
78
156

77.4
35005.90

09
2262.0
31 81
27.9
6786.00

10
2944.0

37 74
39.8
8832.00

11
2661.0
34 34
78.3
7983.00

12

4677.0
63 126
37.1
14031.00

01
5113.0
61 148
34.5
15339.00

02
3682.0
45 98
37.6
11046.00

03
4841.0
43 86
56.3
14523.00

```
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------------
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------------
------
Total
38251.0
392      803
```
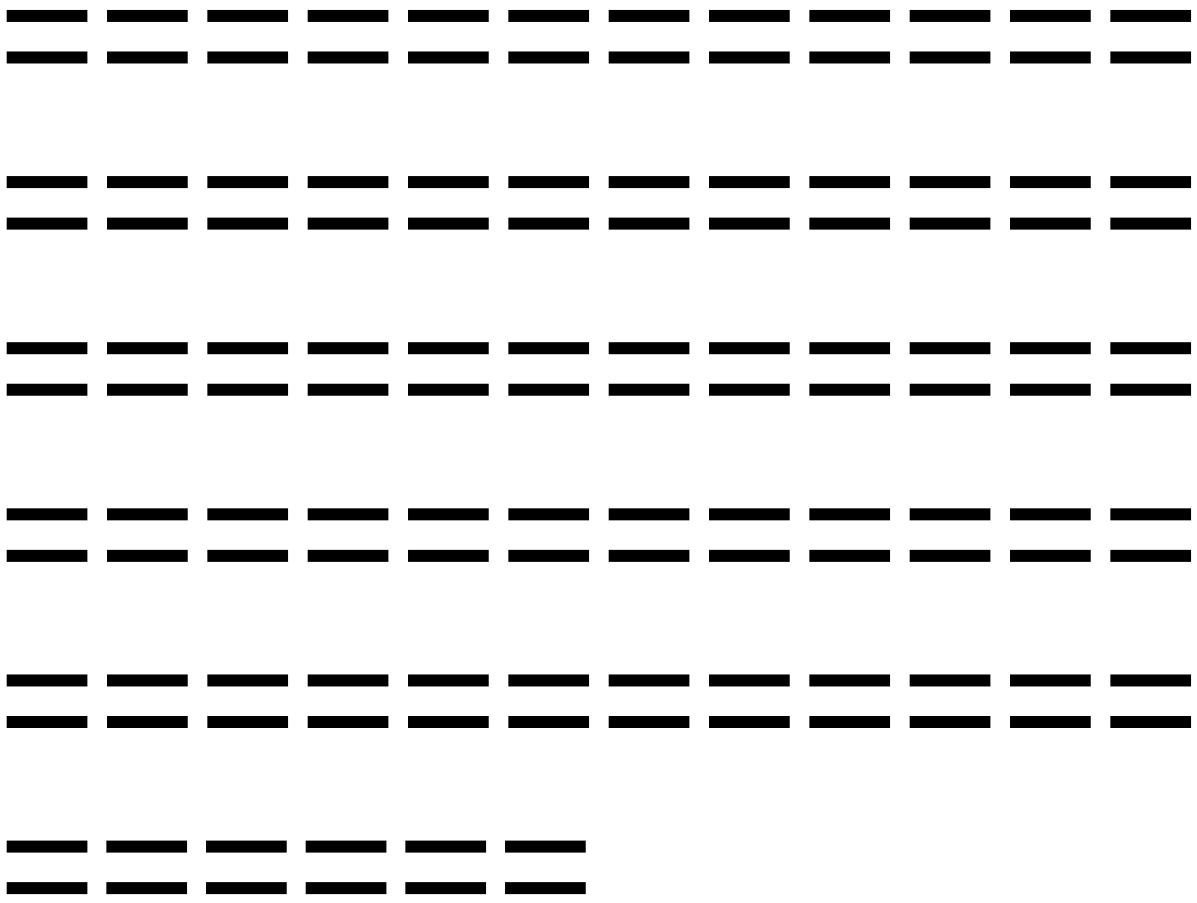

48.6
113545.90

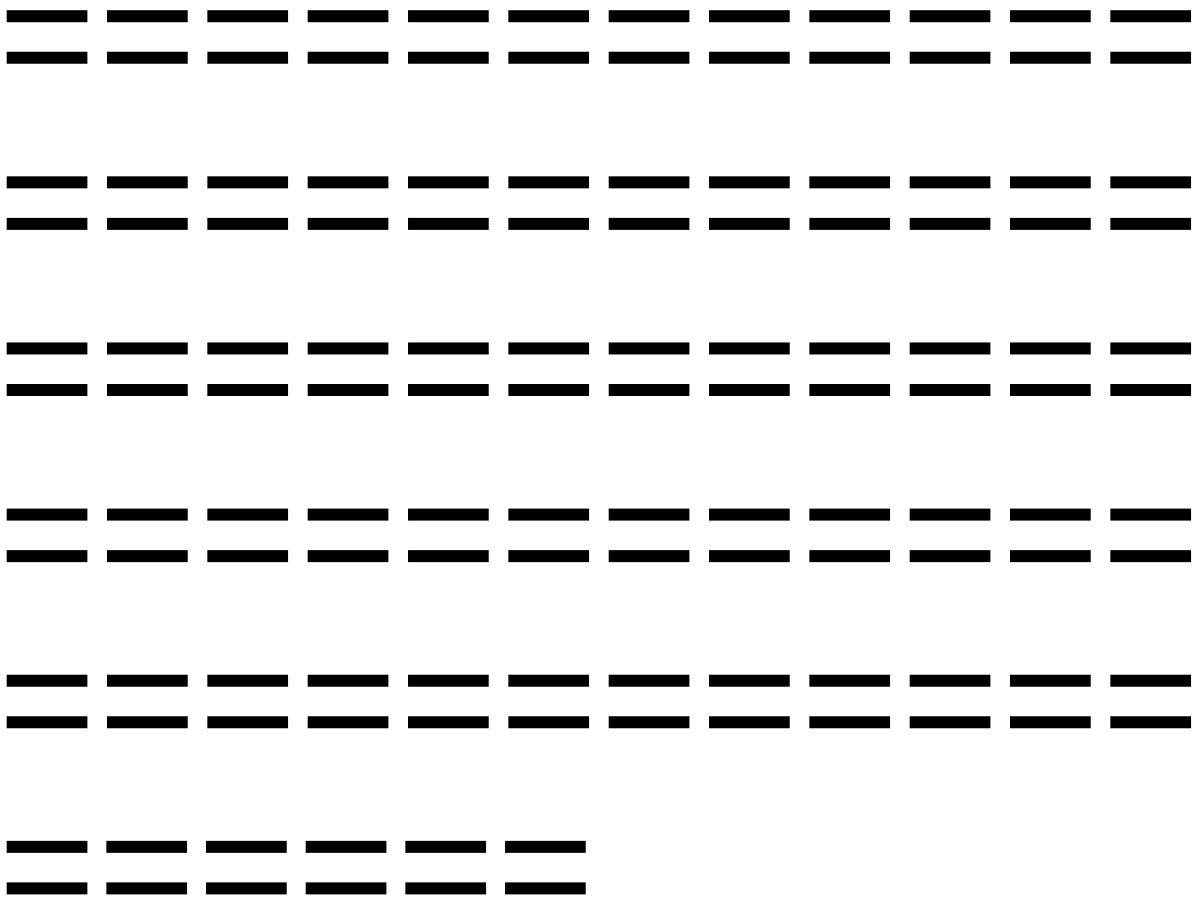


38251.0

392 803

48.6

113545.90

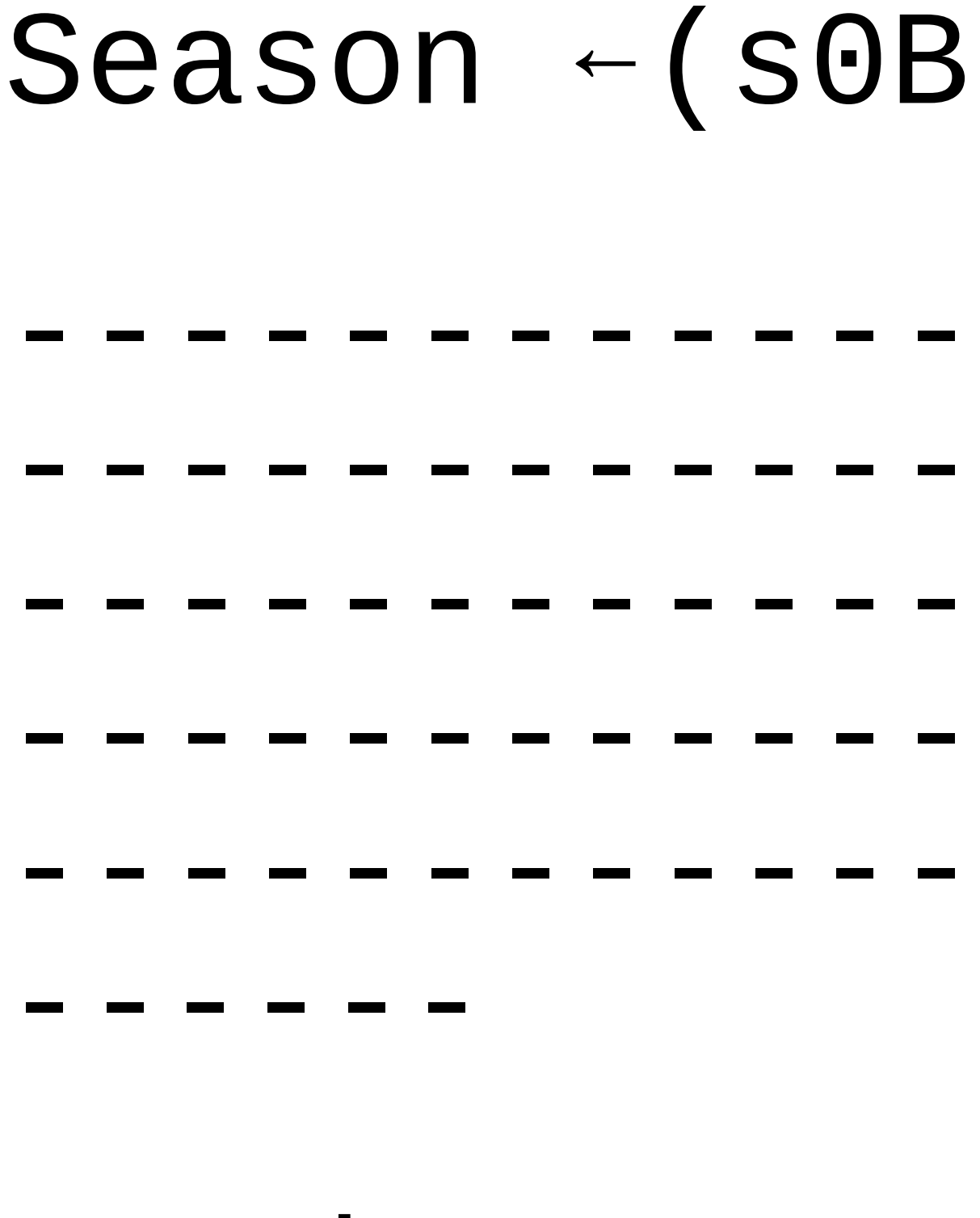


TURKS AND CAICOS ISLANDS: PLANT LANDINGS dated 18/06/99

CONCH

C A I C O S
R O Y A L E
SEAFOODS

←(s3B97


Season ←(s0B
Month
Catch

Days Man Days Days CPUE Value

08
45564.0
107 242
188.3
31894.80

09
82406.5
187 473
174.4
57684.55

10
58711.5
138 378
155.3
41098.05

11
42141.5
125 314
134.2

29499.05

12
49182.5
142 378
130.1
34427.75

01
16981.0
63 174

97.6
11886.70

02
11345.0
47 122
93.0
7941.50

03
10918.0

40 109
100.2
7642.60

04
74369.5
187 507
146.8
52058.65

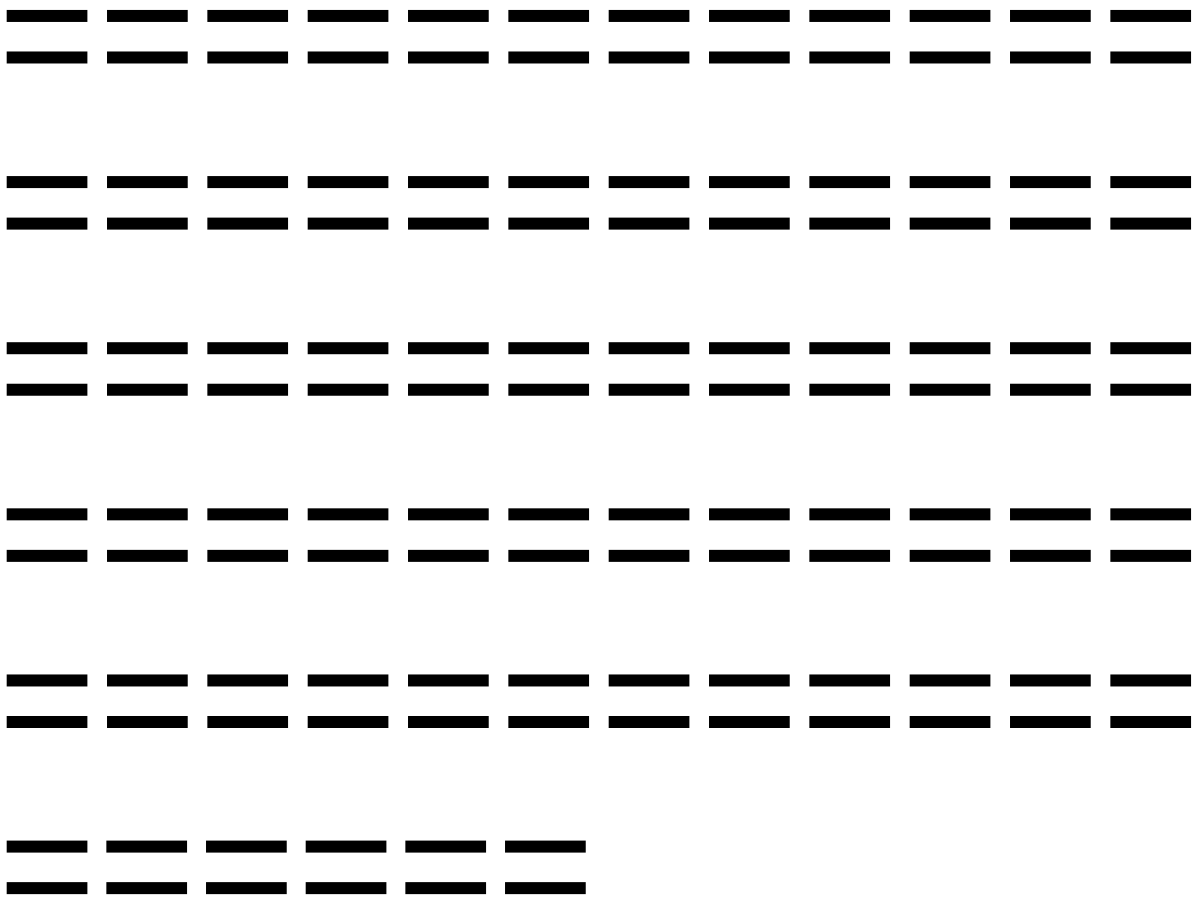
05

60420.0
102 301
200.7
42294.00

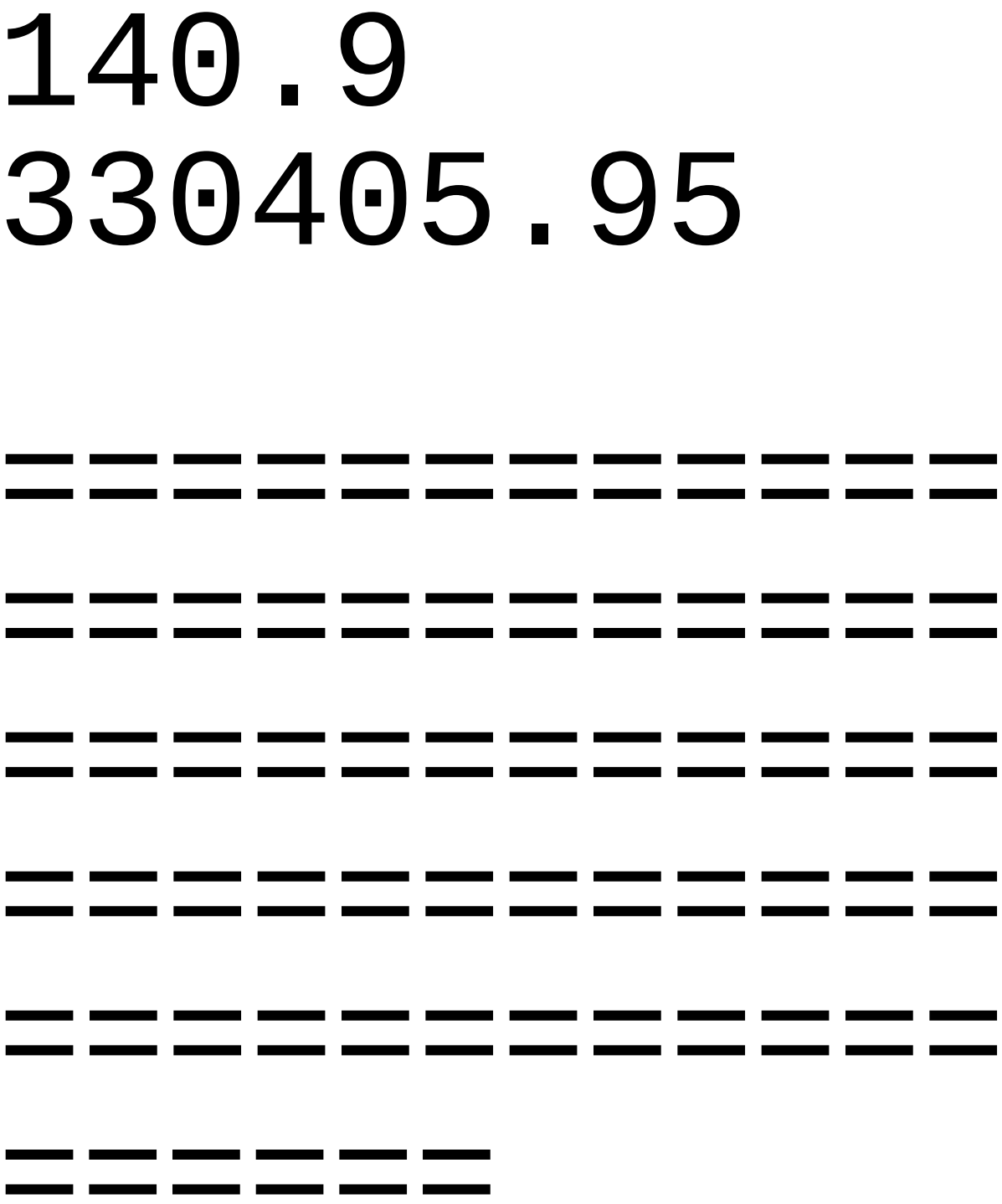
07
19969.0
62 155
128.8
13978.30

Total
472008.5
1200
3152

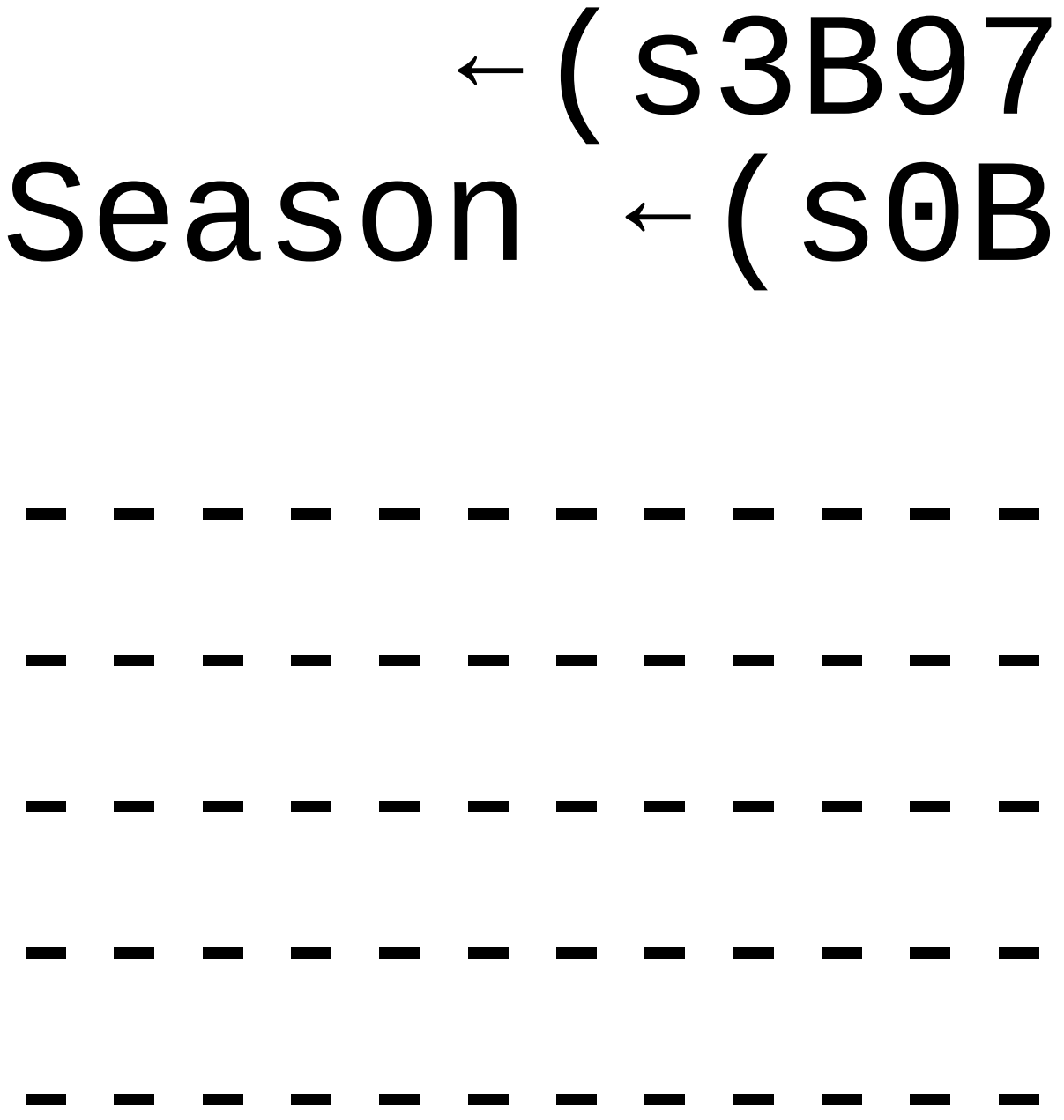
140.9
330405.95



472008.5
1200
3152



H E N S O N IMPORT/EXPORTS


←(s3B97
Season ←(s0B

Month	Catch	Days	Man Days	CPUE	Value

```
----------
----------
------

08
36499.0
97          226
   161.5
25549.30

09
```

75861.0
158 368
206.1
53102.70

10
44150.0
114 273
161.7
30905.00

11
21278.0
92 209
101.8
14894.60

12
14802.0
56 129
114.7
10361.40

01
12366.0
78 161
76.8
8656.20

02
8103.0
67 135
60.0

5672.10

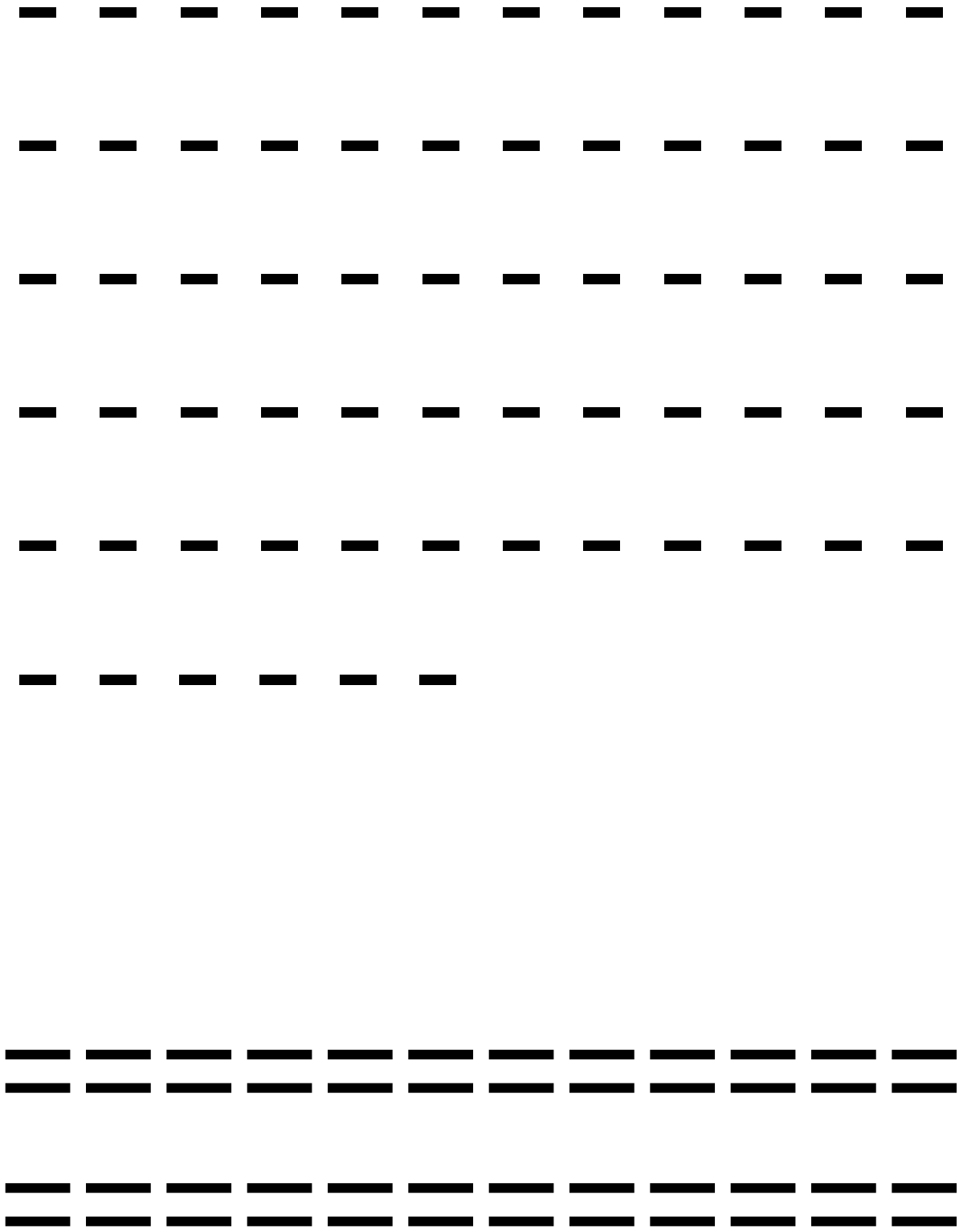
03
14862.0
78 172
86.4
10403.40

04
65676.0
194 763

86.1
45973.20

05
58317.0
125 269
216.8
40821.90

Total
351914.0
1059
2705
127.2
246339.80



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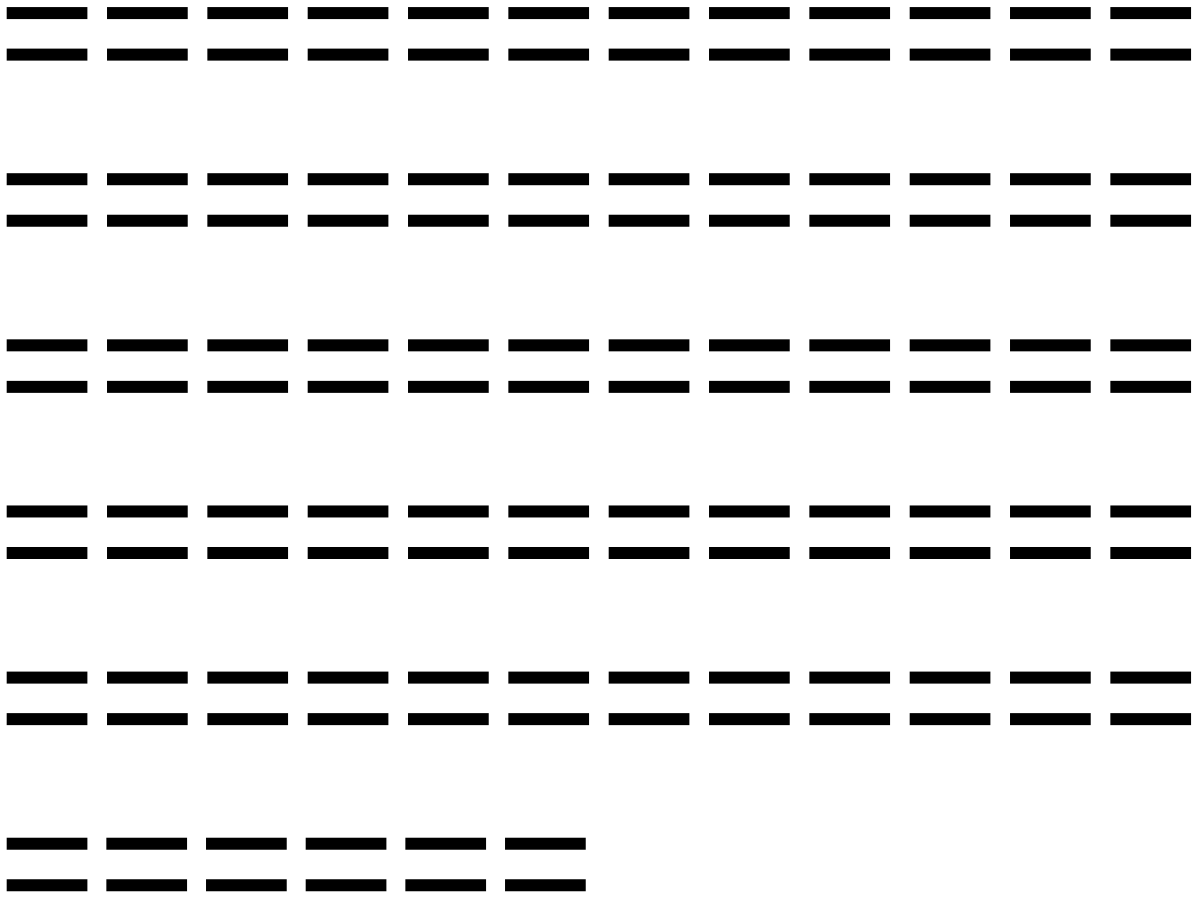
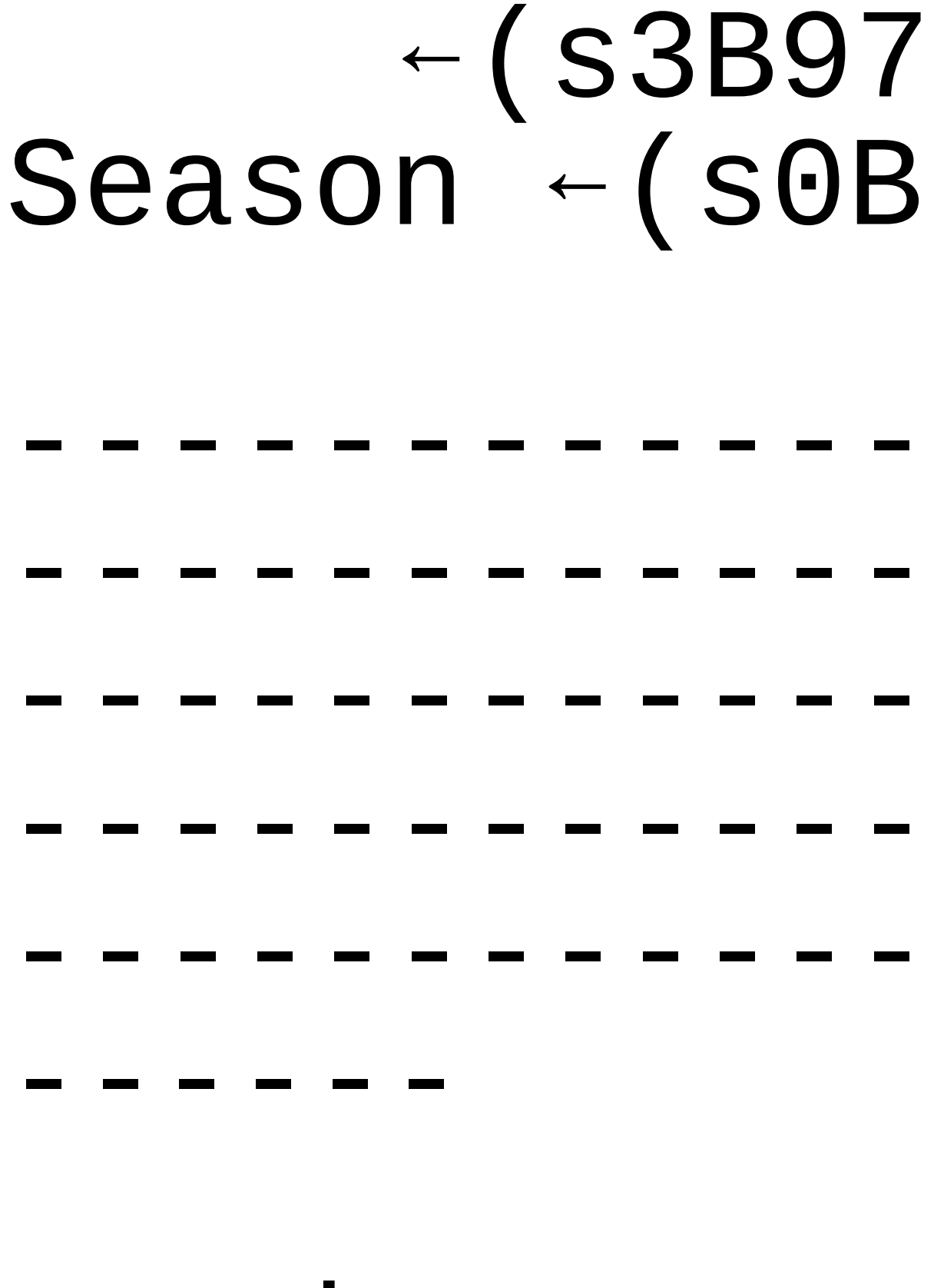
351914.0
1059
2705
127.2
246339.80



PROVO CONCH & SEAFOOD


←(s3B97
Season ←(s0B
Month

Catch
Days Man
Days CPUE
Value

08
30785.0
44 110
279.9
21549.50

09
107087.0
165 285
375.7

74960.90

10
105690.0
173 227
465.6
73983.00

11
78680.0
136 154

510.9
55076.00

12
12015.0
22 27
453.4
8410.50

01
40753.0

71 100
407.5
28527.10

02
24736.0
49 62
399.0
17315.20

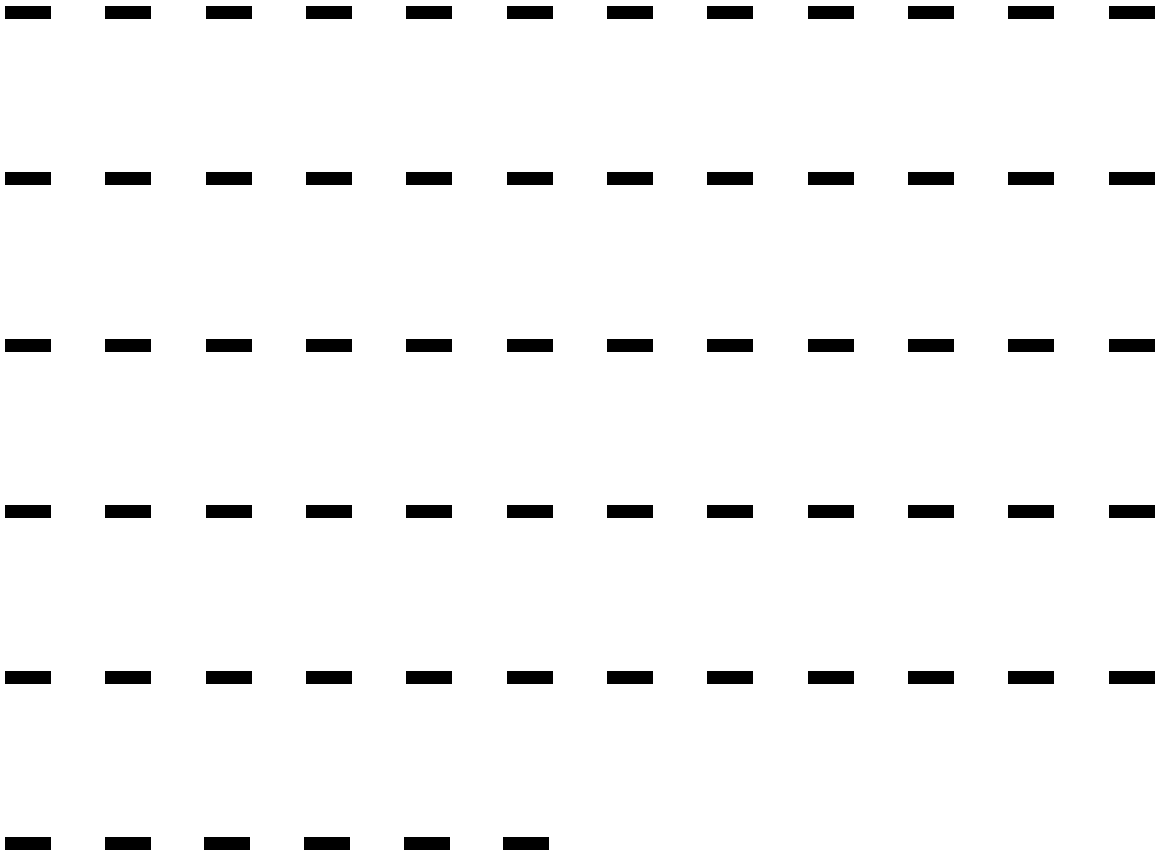
06

38723.0
52 130
297.9
27106.10

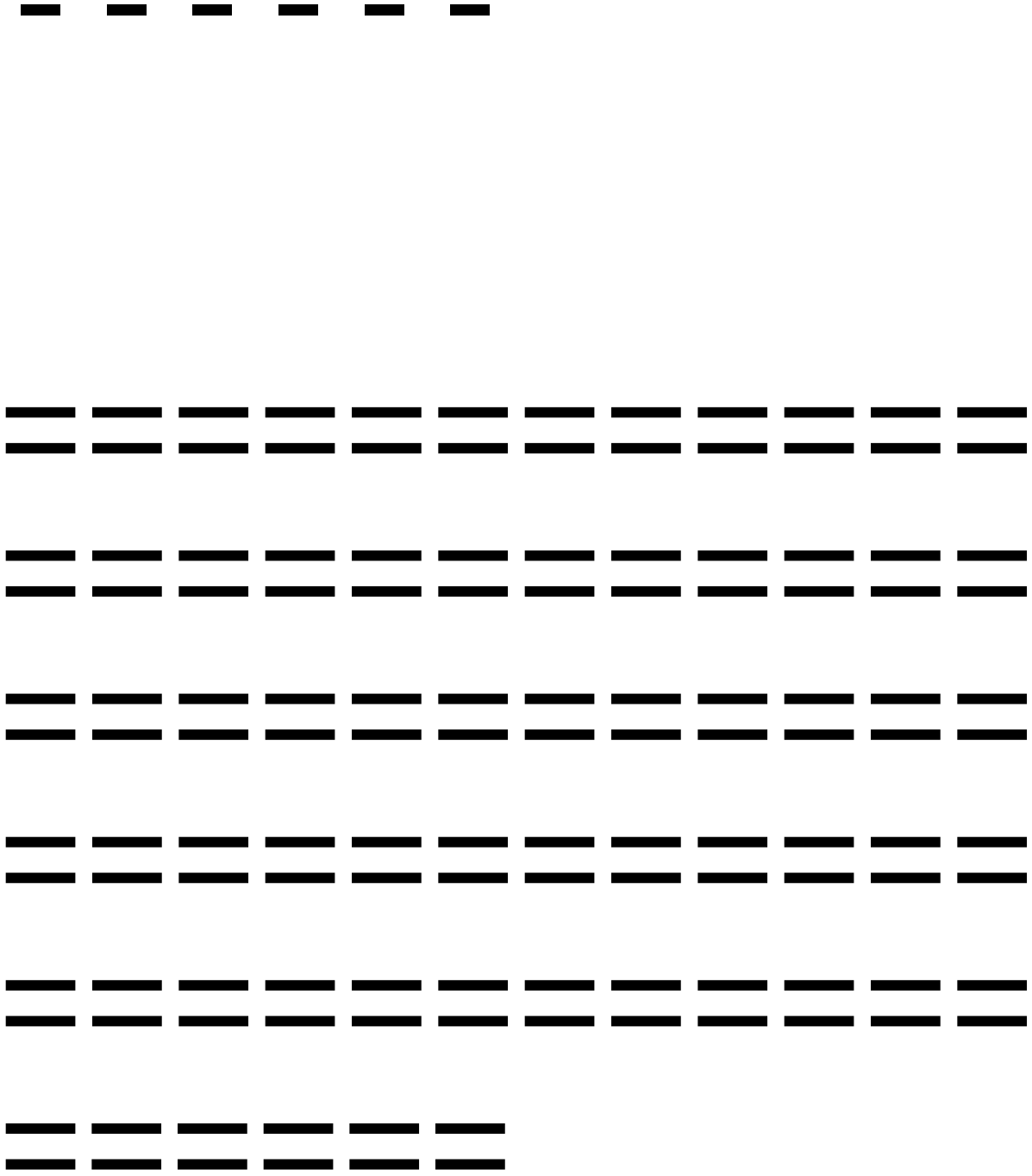
07
44851.0
59 124
361.7
31395.70

TURKS AND CAICOS ISLANDS : PLANT LANDINGS dated 18/06/99

CONCH



Total
483320.0
771 1219
394.6
338324.00



```
483320.0
771      1219
    394.6
338324.00
```

T & D

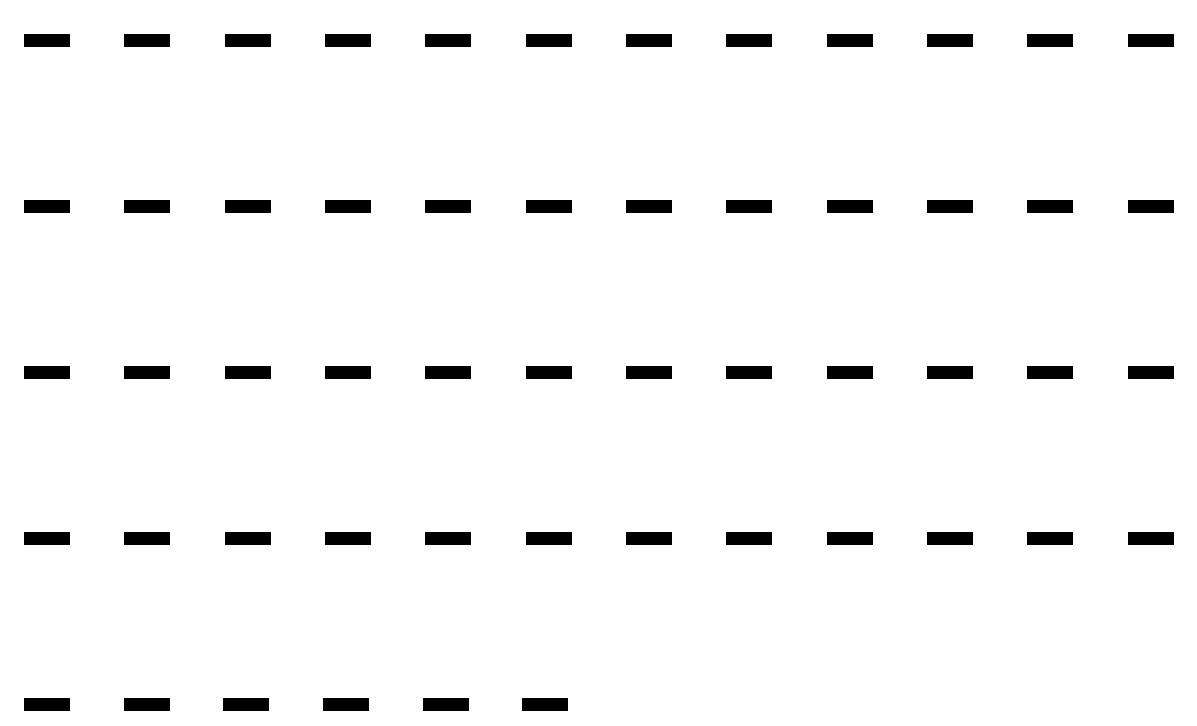
SEAFOOD

←(s3B97
Season ←(s0B

- - - - - - - - - - - -

- - - - - - - - - - - -

- - - - - - - - - - - -



08
15477.0
23 60
258.0
10833.90

09
41303.0
71 192
215.1
28912.10

10
53767.0
107 310
173.4

37636.90

11
34892.0
64 141
247.5
24424.40

12
21384.0
42 119

179.7
14968.80

01
11228.0
22 63
178.2
7859.60

02
10898.0

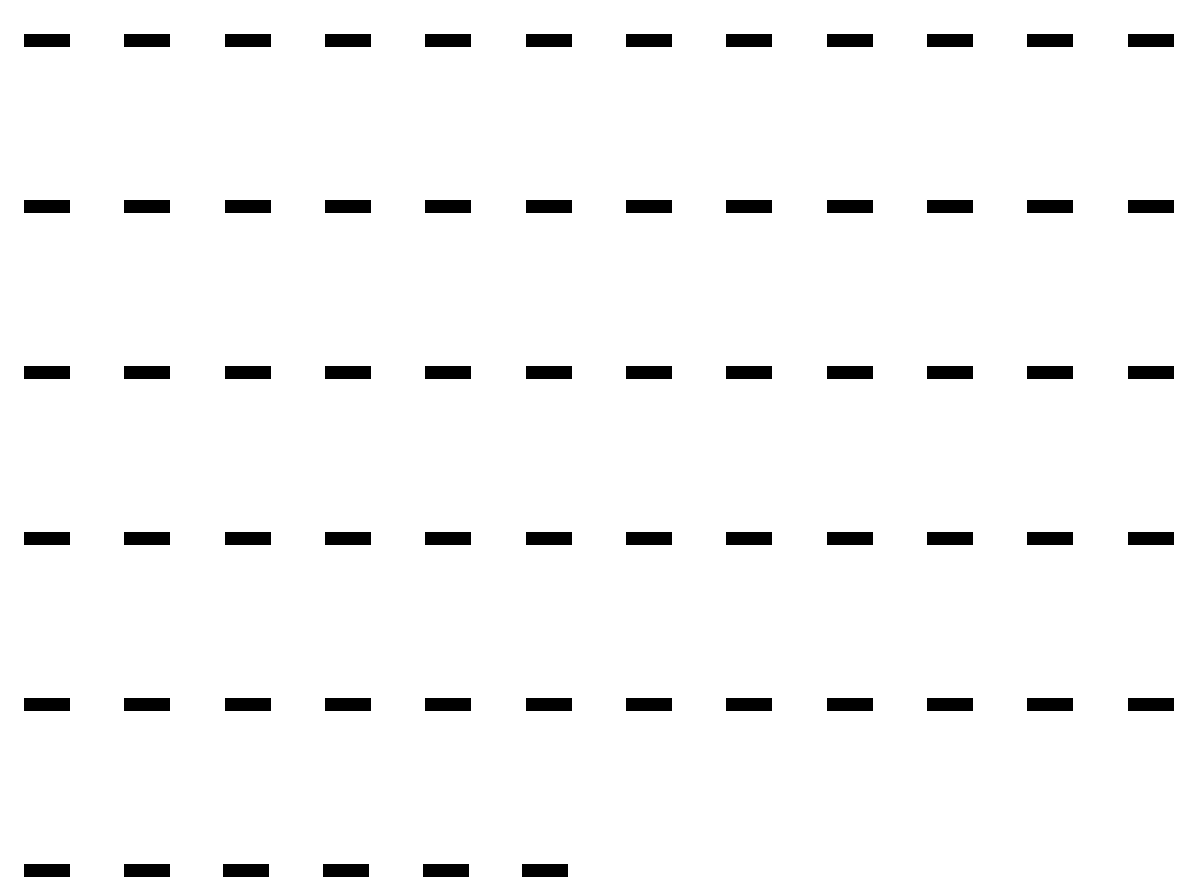
23 56
194.6
7628.60

05
23898.0
34 76
314.4
16728.60

06

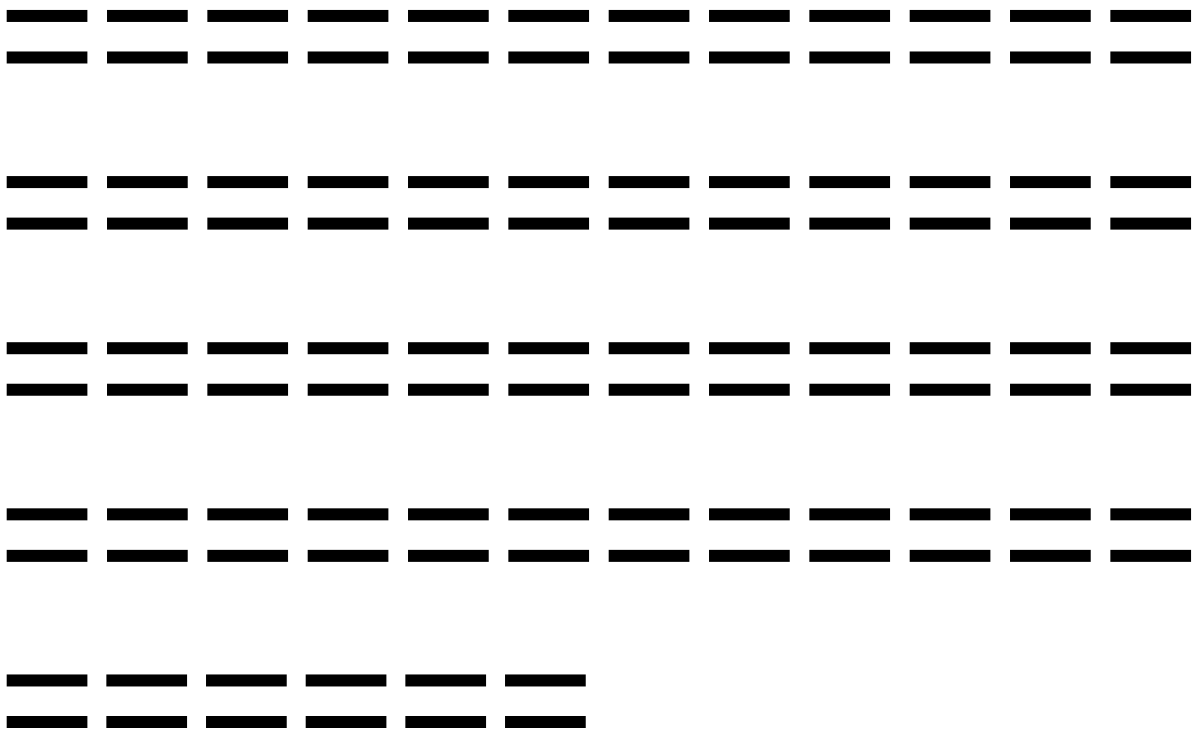
17711.0
24 55
322.0
12397.70

07
22449.0
36 81
277.1
15714.30

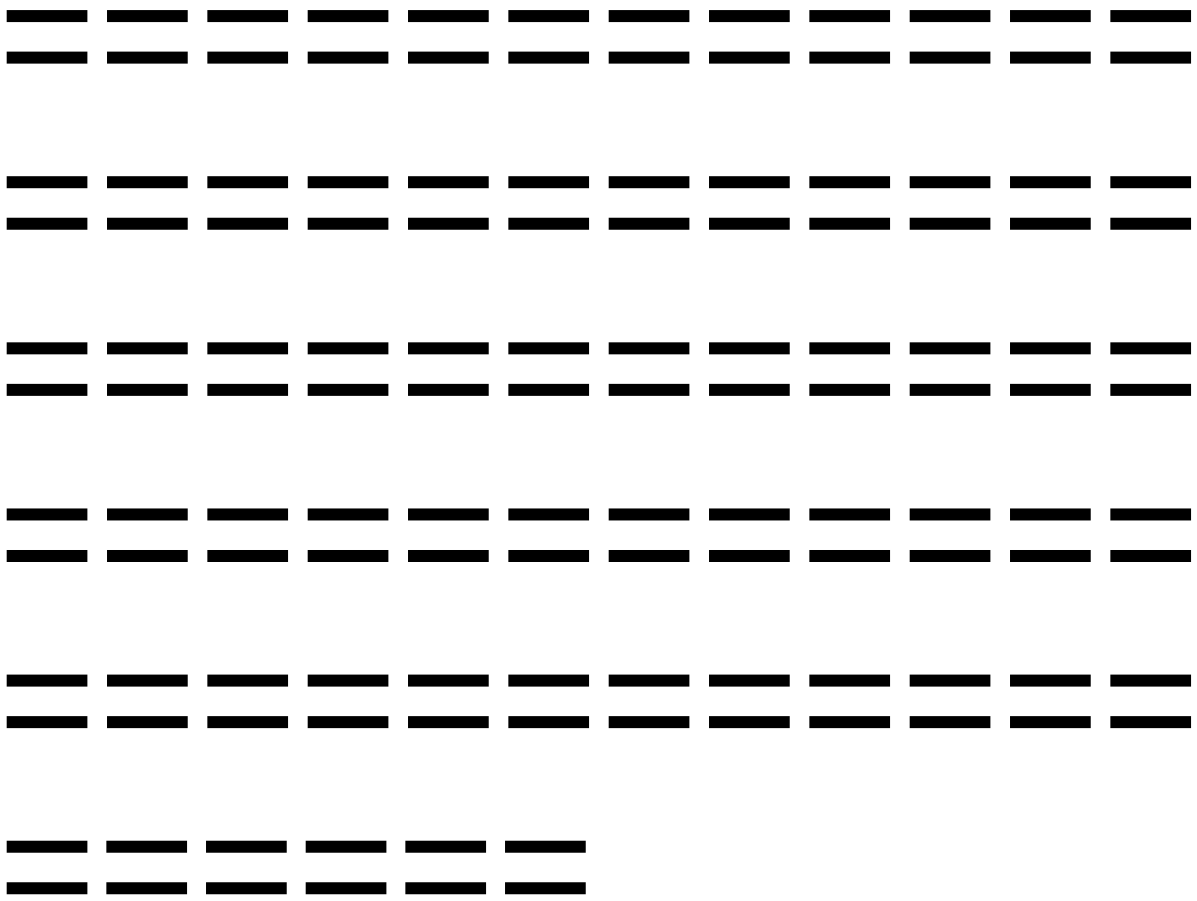


Total
253007.0
446 1153
236.0

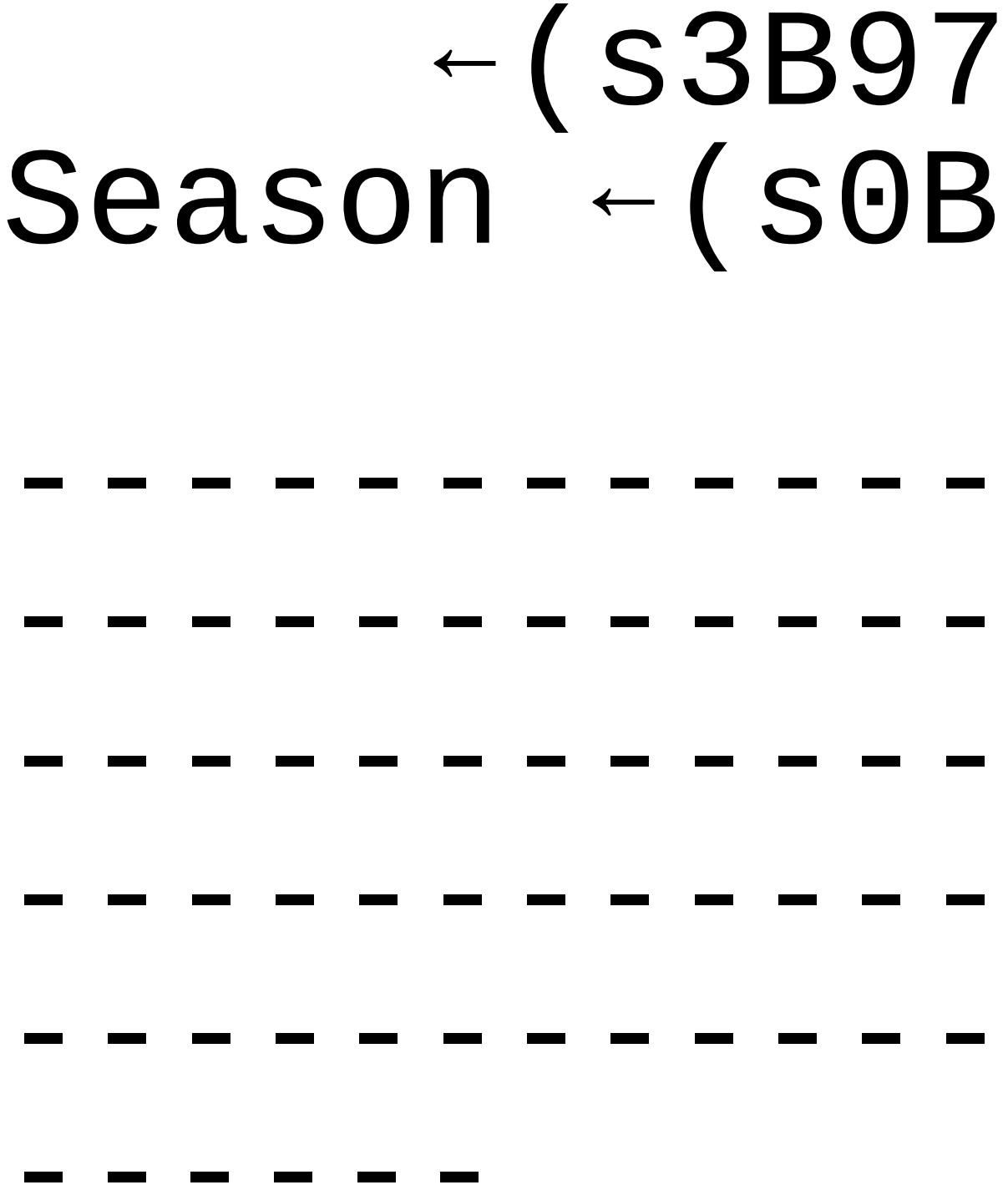
177104.90



253007.0
446 1153
236.0
177104.90



TURKS AND CAICOS SEAFOOD


←(s3B97
Season ←(s0B

Month	Catch	Days	Man Days	CPUE Value

```
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09
22730.0
56          112
   202.9
15911.00

10
15717.0
41          82
```

191.7
11001.90

11
20274.0
48 48
422.4
14191.80

12
28476.0

57 132
215.7
19933.20

01
12280.0
33 85
144.5
8596.00

02

18891.0
43 94
201.0
13223.70

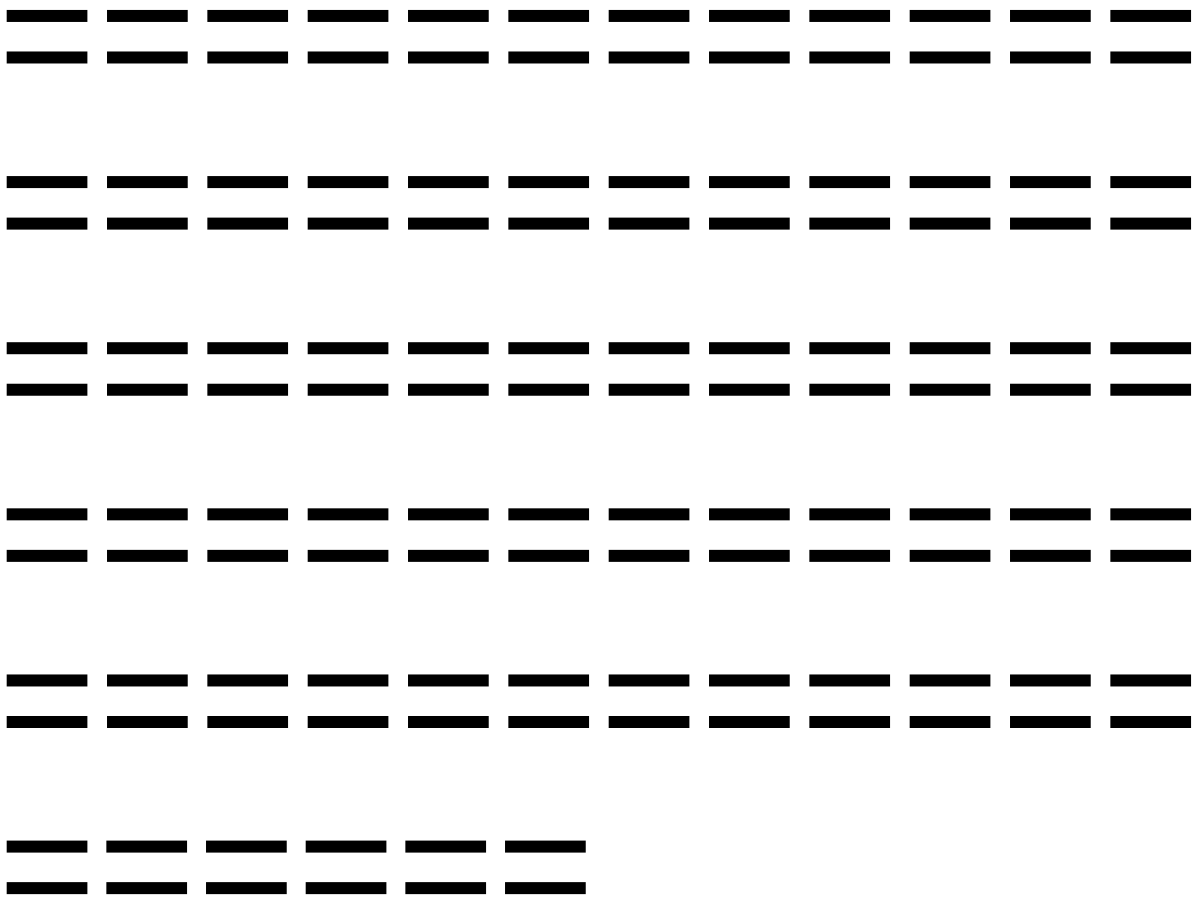
03
8684.0
16 32
271.4
6078.80

04
10229.0
17 31
330.0
7160.30

06
39018.0
55 102
382.5
27312.60

Total
176299.0
366 718

262.4
123409.30

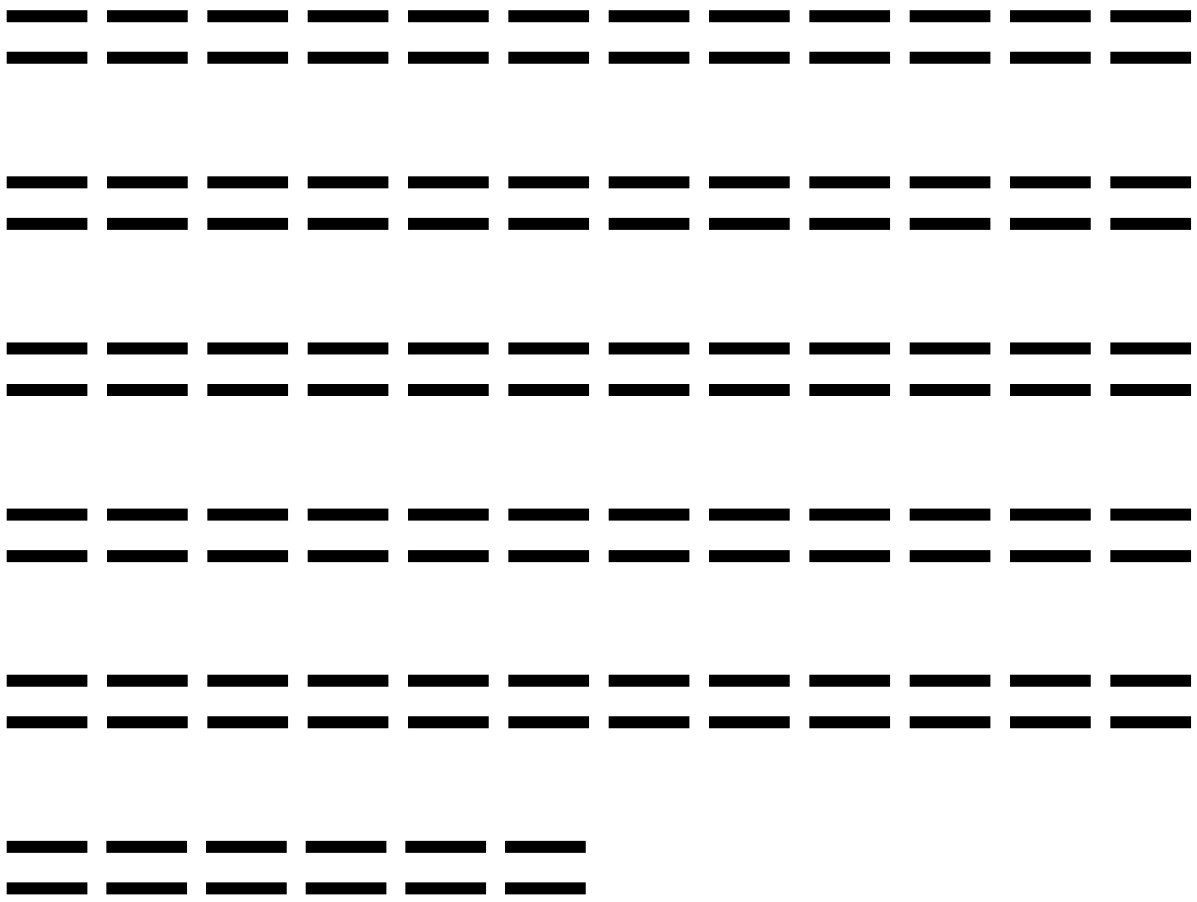


176299.0

366 718

262.4

123409.30



←E←(s10H←&l6
D