SEASONAL ABUNDANCE OF FISH SPECIES IN SEINE NET LANDINGS AT CAPE COAST (GHANA)

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ABSTRACT:

Beach seine landings by fishermen at OLA-Duakor beach near the University of Cape Coast (Ghana) campus were monitored for their seasonal abundance between the period April 1985 and March 1986. Thirty-two (32) fin-fish species belonging to 21 families and 3 genera of crustaceans were recorded.

The abundance of most of the species varied from month to month and could be attributed to the hydrography of the beach, the behaviour of the species, changing balance between birth and death rates and availability of food resources for the fish.

KEYWORDS *Seasonal abundance, fish species, seine net landings, Cape Coast*

INTRODUCTION

The Fisheries Department of Ghana has been recording fish catches landed at certain stations along the coast of Ghana. The vessels involved range from small dug-out canoes to large trawlers which fish in off-shore waters. A well organised fishing in Ghana using beach seines has been going on for some time now. Despite the introduction of motor vessels and their further development to improve upon fishing, the role of beach seines has not declined.

Beach seine landings continue to make significant contributions towards the domestic catch. Statistics have shown that beach siene landings represent a very high percentage of the total landings on the Ghanaian beaches and that the amount of money derived from them is tremendous[1]. For example, in 1971 out of a total of 181,134.9 metric tons of domestic catch landed, beach fish landings was 52,077.9 metric tons representing 28.75% of the total landing. Out of ¢28,551,569 realised from the total landing, beach seine landing was ¢6,734,631 (i.e. 23.59%) [1].

MATERIALS AND METHODS

The relative abundance of fish species in the seine net catches were recorded weekly from April 1985 to March 1986. The nets of some fishing groups were monitored. The species were identified using a manual by Ofori-Adu[2].

The recordings were done directly from the nets when opened by the fishermen. Any species that could not be identified immediately was purchased and taken to the laboratory for identification.

Arbitrary figures were assigned to the various fish species as follows:-
Very Abundant(5), abundant(4), fairly abundant(3), few(2), very few(1), and dash(-) means the species was not represented.

Trichiuridae

Trichiurus lepturus (Ribbon fish)

Between April to July 1985 and January to March 1986, it was either few or very few. In August 1985, it was abundant and fairly abundant from September to December, 1985. The greatest number was in August 1985. The species was available throughout the period of study and scored a monthly relative abundance (MRA) of 2.1.

Carangidae

(a) Chloroscombrus chrysurus (Bumper)

Irvine[3], working on fishes in the waters of the Gold Coast (now Ghana) reported that the species was available from January to April. In contrast the species was available throughout the period of study with MRA of 2.9. It was very abundant in April and abundant in June. Apart from August, October, February and March when it was few, it was fairly abundant in all other months.

(b) Caranx spp (Horse mackerels)

Apart from November 1985 and January 1986 when they were absent from the samples, they were present in all other months and were generally few with 0.9 MRA.

(c) Vomer setapinnis (Moon fish)

It was very few from April to June 1985 and in March 1986. From December 1985 to February 1986, it was few. In all other months, it was either fairly abundant or abundant. The species was available throughout the period of study obtaining an MRA of 2.3 According

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to Irvine[3], the species was available in January and July to November. In this study, these were the months in which it was generally abundant.

Cynoglossidae

Cynoglossus sp (the sole)

Cynoglossus sp was available throughout the period of study becoming fairly abundant in September 1985, few in April and June 1985 and January 1986. In all other months it was very few. The MRA was 1.5. The Cynoglossus sp was reported by Irvine[3] to have been available in June to September.

Sphryaenidae

Sphryaena sp (Barracuda)

It was available throughout the period of study becoming fairly abundant in April and August 1985. It was very few in May, September and October 1985 and very few in all other months. It attained an MRA of 1.6. According to Irvine[3], the species was available from January to April and June to September.

Scienidae

Corvina cameronensis (Small-mouthed weak fish)

The species was available throughout the period of study becoming abundant in April 1985. In May and November 1985, it was fairly abundant. It was few in June and July 1985 and in February and March 1986. In August, September, October and December 1985 and January, 1986, it was very few. The MRA was 1.9.

Clupeidae

(a) Sardinella aurita (Round Sardine) and Sardinella eba (Flat Sardine)

The two species are discussed together because they are closely related and had the same pattern in abundance. They were available throughout the period of study with very few of them in April, July, August and December, 1985. In all other months, it was either fairly abundant, abundant or very abundant. According to Mensah[4] Sardinella spp abound during the upwelling period (i.e. late June to the end of September or up to the first half of October). The small numbers of the species recorded between July and August 1985 is difficult to explain. Their migratory behaviour and other factors like hydrography and availability of resources might contribute to the contrary observation. January to March is a minor upwelling season[1], hence their abundance in those months in 1986. The MRA was 2.8.

(b) Ilisha africana (long-finned herring)

I. africana was available throughout the year becoming very abundant in April and August, 1985, abundant in September and October 1985 and fairly abundant in July 1985. In all other months, it was either few or very few. The MRA was 2.8.

(c) Anchoa guineensis (Anchovy)

The species appeared for the first time in October 1985 and was fairly abundant. It was very few in November 1985 and February 1986 and few in December 1985. In January 1986, it was abundant. Its absence in other months could be behavioural. Its MRA was 0.9.

(d) Ethmalosa fimbriata (Shad)

E. fimbriata was recorded in the samples from July 1985 to February 1986. It was either very few or few except in November 1985 when it was fairly abundant. The species was absent in all other months. Factors like resources or behaviour of the species could influence the abundance. It obtained MRA of 1.1

Holocentridae

Holocentridae sp (Soldier fish)

The species was available throughout the period of study with the greatest abundance in April, May and December 1985 and in January and February, 1986. Few were observed in June and July 1985. In all other months it was very few. The MRA was 2.0.

Polynemidae

Pentanemus quinquarius and Galeoides decadactylus (threadfins).

The two are discussed together since they had the same relative abundance in all the months. They were fairly abundant in February 1986 and few in September 1985 and March 1986. In all other months, they were few. They obtained MRA of 1.3.

Other fin fish

Lichia sp (leerfish) was not common in the landings and was observed from July 1985 disappearing in November and December 1985 and coming up again in January to March 1986. Very few of the species were observed in all the months in which it occurred.

Scyris alexandrinus (thread-fin horse mackerel) appeared for the first time in August 1985, then in September and November 1985 and in March 1986. It was very few in all cases. Irvine[3] reported that in the coastal waters of the Gold Coast (now Ghana) the species was recorded in January to April and June to September. In this study, it was absent in January, February, April, June and July, 1985. The species was absent in most months of the period of study.

Other species occurring in varying abundance include Drepane africana (Spade fish); Rhinobatus sp (guitarfish); Trigon margarita (Sting ray); Ablennis hianes (flat gar fish); Pomadasys incisus and P. jubelini (Roncador); Hemirhamphus brasiliensis (half-beak); Arius sp (sea-cat fish); Lagocephalus laevigatus (globe fish); Stromateus fiatola (Blue fish); Cymbium tritor (Kingfish/Spanish Mackerel); Ophichthus semicinctus (stripped snake eel); Priacanthus arinathus (big-eye) and Remora remora (shark sucker)

Crustaceans

The crustaceans included Panulirus regius (giant craw fish); Callinectes gladiator (marine swimming crab) and Penaeus duorarum (marine prawn). C. gladiator and P. regius were very few in all the months in which they occurred; the former was present in all months except August 1985

P. regius disappeared between July and October 1985 but occurred in all other months. Probably they migrated elsewhere between July and October 1985. P. duorarum was available throughout the period of study. From January to March 1986, it was very few and few in October and December 1985. In the other months, it was very abundant, abundant or fairly abundant. The decline from January to March 1986 could mean that they migrated elsewhere probably for food. Other factors, eg. hydrography could influence the abundance. C. gladiator, P. regius and P. duorarum had MRA of 0.7, 0.9 and 3.0 respectively.

It must be emphasised that "the abundance of a species is not a fixed quantity and it varies from one place to another producing spatial and temporal patterns. Populations show a change in abundance through time. Fluctuations are controlled by a changing balance between death and birth rates and by availability of resources"[5]. These factors probably influenced the abundance of the species at the OLA-Duakor beach.

The above findings are shown in Figs. 1 and 2.

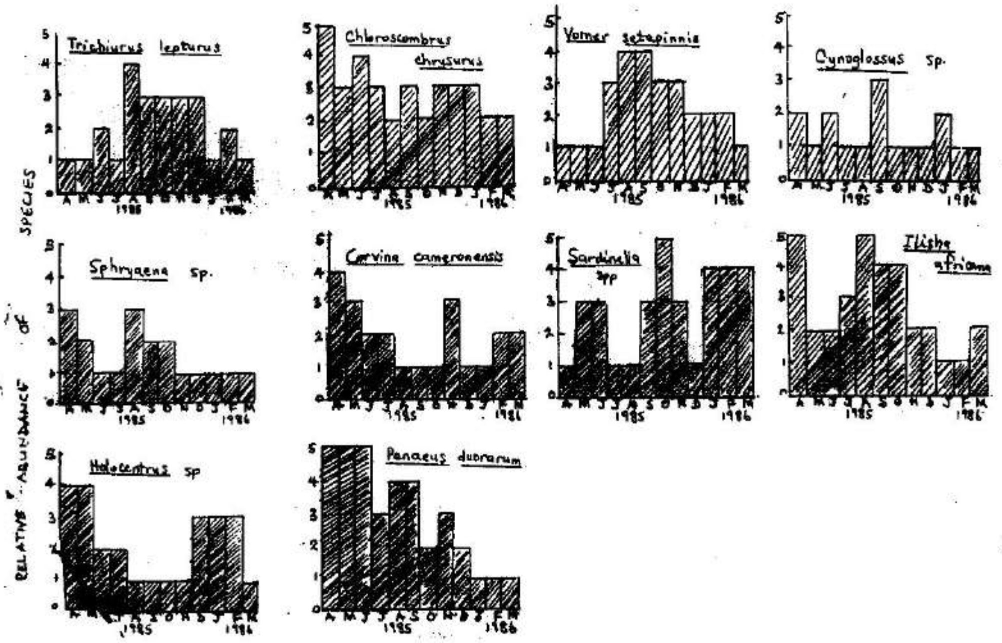

Fig. 1: Abundance of the most dominant fish species recorded between the period April 1985 to March 1986

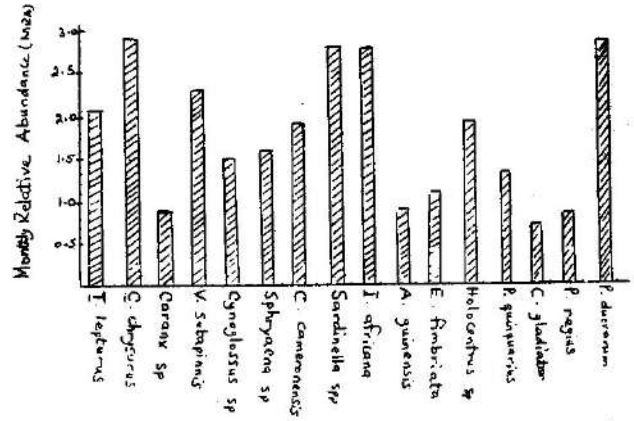

Fig. 2: Showing the monthly relative abundance of Fish species recorded between the period April 1985 to March 1986

CONCLUSION

There were variations in abundance of the fish species landed with beach Seines at the OLA-Duakor beach at Cape Coast (Ghana). The variations in abundance of the fish species could be due to the beach hydrography, migratory behaviour of the species or availability of food resources for the fish.

ACKNOWLEDGEMENT

The author is greatly indebted to the fishing groups for allowing him access to their catch and for providing fish samples for further work as and when necessary.

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Spot Data -

A TOOL FOR SUPPLEMENTING MAPPING EFFORTS IN THE DEVELOPING WORLD

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ABSTRACT

The progress in the total map coverage of the land masses of most developing nations is too slow and insufficient in respect of the exploitation of their natural resources.

The image map which evolved some few years back from satellite has become a useful alternative cartographic product capable of depicting land use and land cover conditions within a short period of time and at a lower cost compared to classical line maps.

The cost associated with image mapping is reasonably affordable, however, the problem of resolution and contrast often affects interpretation of planimetric details. The means of production also can easily be supported by an existing mapping system in a developing world.

Keywords: *image map, mapping, SPOT imagery, developing nations, economic.*

INTRODUCTION

Though there are users of cartographic products who may not have any stringent demand on accuracy, cartographers and photogrammetrists alike have a set of accuracy standards to go by. This may be found in the three kinds of information normally contained in a topographic map, namely:

i) Content - This has to do with the cultural and natural features of the map.

ii) Horizontal location - which deals with the reference graticule, grid and datum.

iii) Elevation - which are the spot heights, contour lines and profiles.

Map Content

This is determined by the photographic resolution and scale or the resolved distances on the ground. Here a criterion for accuracy is defined, using the photograph as a standard. Here, the least identifiable object on the map is taken as 0.25 mm: which must be imaged by 5 resolution element to be identifiable also on the photograph [8].

i.e. $GR = 0.2 \times 0.25 \times$ Map Scale Number
$= 5 \times 10^{-5}$ Sm (in metres).
where GR = Ground Resolution
SM = Map Scale Number.

It is estimated that after the film has undergone various laboratory processes both lithographic and photographic, it could retain about 10 lp/mm, which is the resolving power of the unaided eye [8].

For imaging systems, these have to be enlarged to a point where the unaided eye can resolve.

Horizontal Location or Position

Where the accuracy standard specifies for example that the standard error of horizontal positions should not exceed 0.3mm at the map scale (U.S.), the standard error in relative position of a ground point (σp) is defined as

$\sigma p = 3 \times 10^{-4}$ Sm (in metres).

Elevation

Here also when the accuracy standard requires that 90% (within 1.64σ) of the elevations must be accurate to one-half of a contour interval (e.g. of the U.S.), the required height accuracy (σh) of measuring an individual point is related thus:

$\sigma h = 0.3 \times$ contour interval (C.I.)

DEFINITION OF PROJECT:

Test Area

The region chosen for this project is within the neighbourhood of Boffa, a town situated in the South-West of Guinea Conakry, Fig. 1a.

Fig. 1a. Location of the Study area

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Half of this region, about 72 km² is principally covered with mangrove. The other half is covered with Forest and Villages which are dispersed in the north and along the main road towards the capital Conakry, (Fig. 1b and Fig.3).

Fig. 1b: Image of the Test Area of Level 2b

METHODOLOGY

Available Source of Information

i) Level 1P* (SPOT data): image 1A (Appendix I) treated in such a way as to be adaptable to an analytical photogrammetric restitution instrument (scale of negative-approximately 1:400,000, enlarged 8x for a positive bromide print).

ii) Level 1A (SPOT data): Panchromatic mode and basically a 'raw' data on tape.

iii) An existing topographic map at 1:50,000 - date of publication: 1956.

Rectification and Radiometric Treatment of Imagery Serving as a 'Base'

The area of interest on the image is chosen and a histogram equalisation stretch applied. This is done such that the pixels have values lying between 0 and 255, rendering the image more expressive and interpretable. It is normally done by choosing areas without water and cloud cover. This area is rectified into an U.T.M. projection. A topographic map at scale 1:50,000 was used for this.

Seven control points uniformly distributed over the imagery were identified. These were features identified on both map and the image which were road intersections, road/river intersections and branch points of streams. All the control points and four other points (UTM Coordinates) read from the topographic map and situated at the four corners of the image were measured using a Benson digitiser with an accuracy of 0.02mm. Using the 4 points, an affine transformation is used to transform image coordinates into map (UTM) coordinates. Then based on the calculated unknowns the rest of the points were transformed with a RMS of 26.59m (Table 1).

This must be expected since errors of 15-20m in position may occur in the topographic map coupled with measuring and identification error; hence the residual error. By applying a bicubic convolution and using a filter, both the texture and the radiometric detail appropriate for cartographic work are enhanced.

A half-tone negative film is obtained to serve as a 'base' (See Fig. 2).

Data Processing

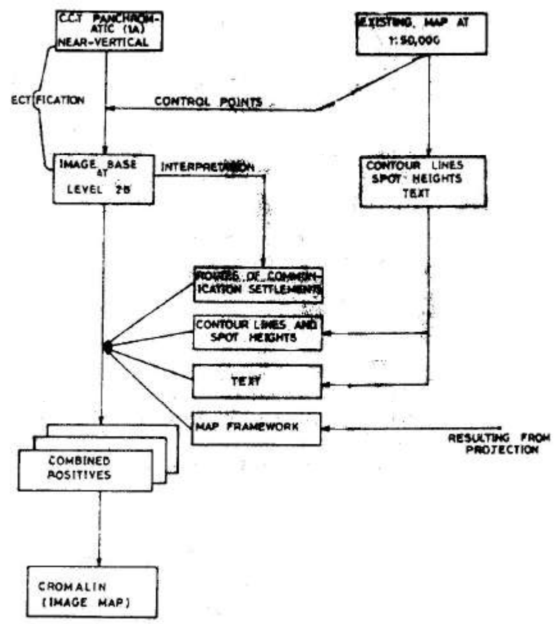

Fig. 2 Schematic drawing of the main processing steps

Interpretation of Imagery: A monoscopic interpretation was done. A tracing paper was laid over the 2B film negative and planimetric information directly traced over it.

Towns: The only town existing in the area of study was Boffa which clearly stood out without much problems.

Villages: These appeared as black on the negative but white on the bromide (positive) print. They could easily be made out except that similar white dotted areas existed. It was generally found that almost all the villages were partially covered by the forest.

TABLE 1:

Geographic representations used: GEOGRAPH-GE............CLGBUTM 28

LonLatXYNumber	1 : -14.14	10.15	582136.823	1133046.646
	2 : -14.00	10.15	609518.058	1133121.060
	3 : -14.00	10.00	609602.881	1105478.405
	4 : -14.15	10.00	582200.433	1105405.730

Geographic representations used: GEOGRAPH-GE...... LGBUTM 28

The degree of polynomial is : 1

Num.	Coord.	imag 1	Coord	imag.2	Coord.	imag 2	Corr	Residual
1.	606965.6	1127361.6	2452.8	469.9	2453.6	470.3	0.816	0.440
2.	587440.9	1130148.8	488.6	501.4	487.8	504.4	-0.858	2.991
3.	586060.5	1128400.0	391.6	697.6	392.6	698.2	0.946	0.537
4.	585530.8	1120208.3	524.0	1514.0	525.3	1512.3	1.266	-1.735
5.	605701.5	1110539.9	2708.1	2141.6	2708.9	2144.9	0.747	3.232
6.	594943.2	1118832.9	1476.3	1502.1	1473.6	1499.0	-2.602	-3.151
7.	607553.4	1124686.3	2571.4	726.5	2571.1	727.2	-0.314	-2.314

Residual (RMS) in X = 1.272 (Pixels)

Residual (RMS) in Y = 2.335 (Pixels)

Residual (RMS) in position = 2.659 (Pixels)

Routes: Major routes were easily found without any problem - except that the high reflection by these and the houses in the town made the tracing difficult. Secondary routes and tracks were such that they could only be found after studying the local situation; in relation to farm lands, nearby villages and available source of water.

Difficulties: The contrast as well as the resolution were not good enough and therefore made it difficult to sort out the secondary routes and tracks.

- Roads reaching villages were often partially covered by trees and were difficult to see where they joined when inside the village.
- The houses themselves in the imagery seemed to overshadow roads. This is characteristic of near-vertical imagery as opposed to the oblique.

Conclusions: The imagery whether used for protogrammetric compilation of planimetric information or purely monoscopic/stereoscopic visual interpretation will need a careful study and a particular knowledge of such an environment in order to make the right deductions. For the fact that the area had less planimetric details, the scale at 1:50,000 was acceptable.

Integration of the Different Linear and Point Information on the Map

Roads and houses were obtained directly from the interpretation of the imagery. Contours and spot heights were extracted from the existing topographic map at scale 1:50,000.

These were scribed on scribe coats for the various combined positive to be made.

For hydrography (Cyan) and vegetation (green), these two themes which are linear and zonal respectively were well portrayed by the 'image base' in such a way that it was no longer necessary to scribe them or treat them like the others. The following positives - red, black, bistre and the half tone image for the base were combined for a cromalin proof. (Fig.3).

RESULTS AND DISCUSSIONS

Investigation of Accuracy:

Metric Accuracy: The following results were obtained for the rectification.

RMS in X = 1.272 pixels
RMS in Y = 2.335 pixels
RMS in position = 2.659 pixels, ie. 26.6m

The required accuracy is $\leq$ 20m with level 2B geometrically corrected images.

This inaccuracy of about 6m can be attributed to the fact that

i) points taken as branch points of rivers may not be precise.

ii) many points might have changed on the map which is 34 years old.

Fig. 3: Image map - (A cromalin proof) from SPOT imagery

iii) and also errors in measurements by the operator.

Semantic Accuracy:

The only document available for a check was also the only published map for the area, dated 1956. It was realised that apart from the correctness of the planimetry resulting from the interpretation process, many changes had also taken place in addition to what has been depicted on the topographic map. This was in respect of growth of towns, villages and routes of communication.

With these results both the planimetry and content, it could be concluded taking into consideration certain inaccuracies in measurement, that the data, is useful for the production of image maps at scales 1:50,000 and smaller for inventory and monitoring purposes but for line maps at scales 1:100,000 and smaller.

COST ANALYSIS

Cost of imagery is by far an advantage over serial photographs whose cost vary a lot (See Table 2).

The photo-interpretation phase did not pose much problem. However, the phase of field completion may involve much time and therefore cost because of uncertainties of identification due to resolution and contrast.

The cyan (hydrograpny) and green (vegetation) were not scribed or drawn and therefore their plates were eliminated. This provided relatively good time savings, reducing material expenditure and cost.

The overall cost therefore was relatively reduced when compared to traditional methods in a similar level of mapping. In respect of cost the process was compared to a revised map with traditional method of mapping.

NB: The choice of colour is left to the 'tastes' and convention of an established mapping institution. In the case of the river this may be scribed where contrast does not allow clarity. Colour imagery increases the rate of detection but increase cost.

TABLE 2: COST ESTIMATES

PROCESSING STEPS	K=COST OF A / COST OF B	REMARKS
Acquisition of image and pretreatment	K=10 to K=13	
Aero/Spatio		Cost affects only B
Restitution		
Photo-identification (interpretation)	K = 6	The cost for the image map depends to a greater extent on the quality of the image
Completion	K=½ to K=1/3	The cost depend on the quality of the image
Drawing		Cost on the image map does not include hydrographic (Blue) and vegetation (green) because they were not drawn or scribed.
Separation of colours	K = 1	
Reproduction (Impression) 1000 samples.	K = 1	
Total Cost	K = 2	

A = Tradition method for a revised topographic map
B = Image map from SPOT

CONCLUSION

In the light of the above, it can be seen that SPOT data when supplemented with other map information, and keeping sufficient internal map precision can achieve a good economy. The work was done in such a way as to be adaptable to an existing mapping structure in a developing country. While the cost of production is relatively cheap, it makes its introduction quite feasible. The infrastructure requirement and processes involved can therefore be expected to be cost-effective and operational.

The data and therefore the product can support or supplement world mapping efforts sufficiently enough for the inventory and exploitation of natural resources and in general to accelerate the rate of national development.

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APPENDIX I

SPOT PRODUCTS

The different levels for the preprocessing of a SPOT scene (nominal coverage: 60 km x 60 km) recorded in panchromatic or multispectral mode are:

Level 1A:

This is basically a 'raw' data, the only processing performed being equalisation of the response of the CCD* detectors. Level 1A data are intended for users requiring imagery that has undergone a minimum of preprocessing.

Level 1B:

This level involves radiometric and geometric system corrections (compensation of rotation of the earth, satellite perspective efforts, viewing angle and effects of satellite forward motion (desmearing). The location accuracy is 1500m (r.m.s.) for vertical viewing.

Level 2A:

This is a precision processed level. Radiometric correction is as for level 1B, but transformed into a desired cartographic projection (UTM, Lambert Conformal, Transverse mercator etc.) using uniquely the satellite data; orbit parameters and altitude. The location accuracy is 80m (r.m.s.).

Level 2B:

Geometrically corrected image with the help of ground control points.
The image is rectified according to a given cartographic projection or according to the projection of the map used. It is therefore possible to determine the localisation of each pixel in cartographic coordinates. The location accuracy is better than 20m (R.M.S.).

Level S:

This level of preprocessing involves scene rectification relative to landmarks to ensure registration with another scene used as a reference to within 0.5 pixels i.e. within 5 or 10 m depending on the image mode. Level S products are typically used for multidate studies.

Level 1P:

This is a level 1A image anamorphosed in order to eliminate variation of scale due to satellite perspective views in the direction of the lines in view of the photogrammetric restitution after histogram equalisation stretch and local contrast enhancement.

**CCD (Charge coupled Devices) is a microelectronic silicon chip, a solid state sensor that detects light*