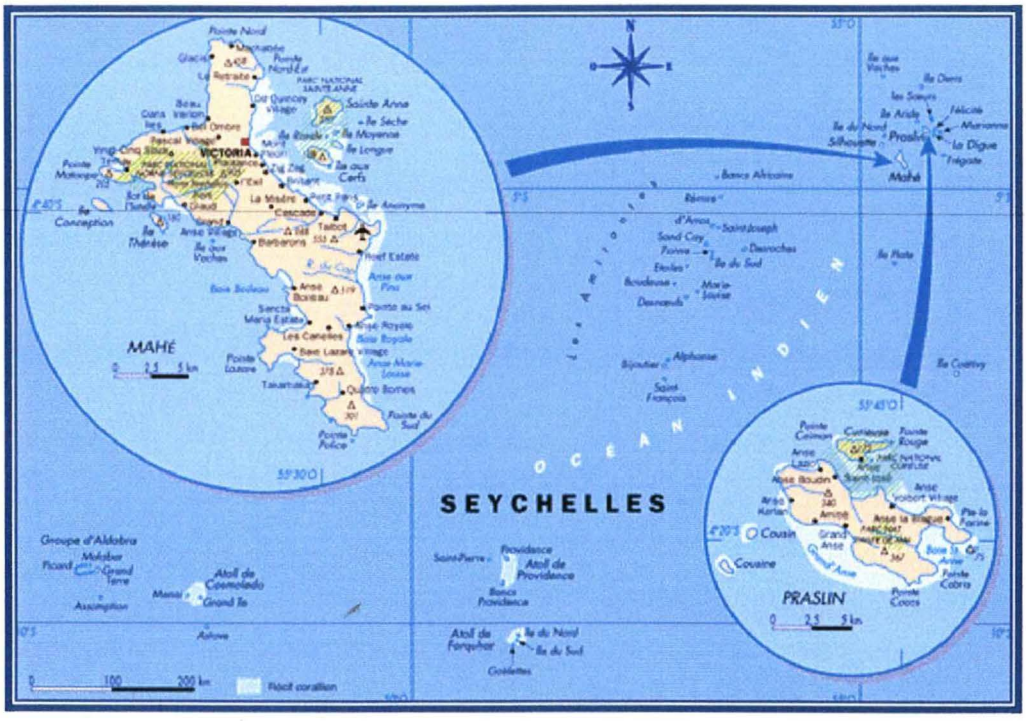
République des Seychelles

Ministère des Affaires
Etrangères
Coopération et francophonie
20, rue Monsieur
75700 PARIS

MONOGRAPHIE

LES SEYCHELLES



Mission du 25 juin au 29 juin 2001

François ROGER

Septembre 2001

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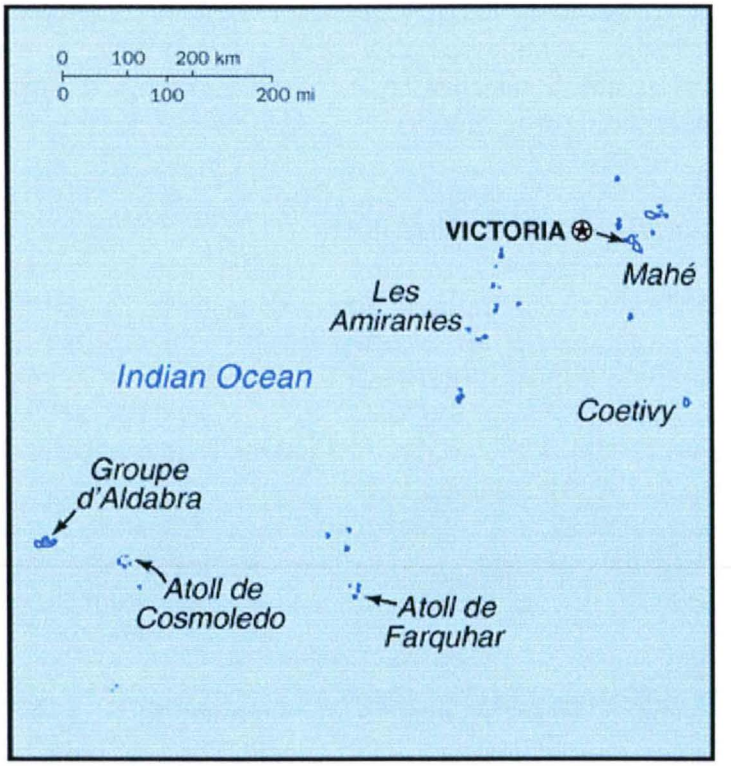
ANNEXES

I - INTRODUCTION

Les données générales (géographie, économie, etc.) ainsi qu'une carte générale sont présentées en **Annexe 3** de ce document.



L'élevage seychellois est dominé par l'élevage d'espèces à cycle court : volaille et porc. L'élevage des ruminants est peu important et reste tributaire de la faible disponibilité de surfaces pâturables. Les productions locales relatives aux volailles permettent une autosuffisance en ce qui concerne les œufs et une quasi autosuffisance pour les poulets de chair (sup. à 80 %). La production porcine couvre 60% des besoins locaux.

La situation sanitaire est exceptionnelle : il n'y a **pas de maladies infectieuses importantes déclarées.** Il resterait cependant à démontrer l'absence de circulation de certains agents pathogènes. Par ailleurs, les services vétérinaires officiels estiment qu'ils ne sont pas à l'abri de l'introduction de maladies, en particulier des maladies virales majeures. Ils considèrent que le risque s'est accru depuis quelques années (cf. crise de la fièvre aphteuse) et que la visite de nombreux touristes, ainsi que l'importation de denrées alimentaires d'origine animale, constituent une risque désormais plus important d'introduction qu'il conviendrait d'estimer et de prévenir.

De nombreuses lignes aériennes mettent les Seychelles en liaison directe avec les pays suivants :

- Kenya
- Afrique du Sud
- EAU (Dubaï)

- Madagascar
- Ile Maurice
- Réunion/France
- Europe (France, GB, etc.)
- Asie : Bombay et Singapour

Les Seychelles font partie de la SADC (*Southern African Development Community*). Le secteur élevage et maladies animales est coordonné par le Botswana. Aucune action dans ce domaine n'est entreprise aux Seychelles par la SADC, excepté le financement de quelques stages (1 stage en épidémiologie en Zambie).

2 - ELEVAGE ET CONTRAINTES SANITAIRES

Bovins : **1.500 têtes**. Production de fumure, de viande et de lait. Une ferme d'Etat (130 têtes) diffuse des géniteurs et animaux pour l'engraissement. L'abattage des femelles demande une autorisation des autorités vétérinaires. Race créole : introduction d'animaux de divers origines dont l'Europe, l'Ile Maurice, l'Afrique du Sud (frisonnes, jersiaise, zébus, etc.). Il n'y a pas eu d'introduction récente (1971- 72 : Afrique du Sud) mais il y a en projet l'introduction de zébus brahmanes depuis l'Afrique du Sud.

Pathologies : (les maladies décrites seront pour les différentes espèces, les maladies infectieuses (A et B de l'OIE), les maladies transmises par les tiques. Les parasitoses seront mentionnées.

- Babésioses et anaplasmose : incidences apparemment faibles.
- Seules les tiques *Boophilus* spp. - et *Rhipicephalus* spp. pour l'espèce canine - sont présentes.
- Mammites fréquentes (ferme d'Etat en particulier).
- Leptospirose (fréquente chez l'homme, cf. infra) : pas d'information sur l'infection chez les ruminants et porcs.

- Parasites internes (helminthes), absence de *Fasciola* spp. ; 1 cas de douve du pancréas rapporté.

- **Aucune des maladies de la liste A de l'OIE n'a été mise en évidence**. La fièvre de la vallée du Rift (constatation également faite par les services de santé) n'a jamais été suspectée.

- Maladies de la liste B : il est à noter notamment que la fièvre charbonneuse (charbon bactéridien) et le charbon symptomatique n'ont jamais été suspectés. Dermatophilose (à souligner : absence *d'Amblyomma* spp.) : un cas de suspecté. La cowdriose n'a jamais été mise en évidence. La tuberculose n'a jamais été détectée (absence de lésions à l'abattoir). Absence de la brucellose (les avortements ne semblent pas être une contrainte sanitaire).

Petits ruminants : **effectif très faible**. Ovins : importés de Rodrigues (Maurice) en 1984. Pas de production commerciale

Porcins : **9000 têtes**. La dernière importation de porcs date de 1991 (Afrique du Sud). Une ferme d'Etat produit des géniteurs. Les services de l'élevage envisagent de procéder à une nouvelle importation de géniteurs (et/ou de semence). Des contacts ont été pris avec l'Afrique du Sud et le Zimbabwe mais en raison de la prévalence de maladies majeures dans ces pays (FA, pestes porcines), les autorités seychelloises n'ont pas encore pris de décision relative à cette importation[1]. L'aliment est produit par la société d'Etat SMB (contrôles effectués par le laboratoire SMB). Farine de poisson, importation de maïs. Les races utilisées sont les suivantes : Large White ; Duroc ; Hampshire ; Sattleback. La distribution d'eaux grasses est interdite. Elevages modernes, semi-améliorés (effectifs de 5 à 350 têtes) et traditionnel (animal gardé *backyard*). 60-65% produit localement : importation pour transformation. Les capacités de production peuvent augmenter jusqu'à 100%. La mise en place d'un élevage demande d'autorisation au gouvernement (Ministères concernés : agriculture, environnement, territoire, santé).

Pathologies : pas de contraintes sanitaires majeures.

- Suspicion de cas de leptospirose
- Quelques cas de rouget rapportés mais pas depuis quelques années
- Autres problèmes cutanés : gale, staphylococcie (?)
- Le premier cas de cysticercose a été déclaré il y a 3 mois (lésion trouvée à l'abattoir). Cette infestation n'avait jamais mise en évidence aux Seychelles (de même que la trichinellose). L'annonce par les médias de ce cas a conduit à une baisse de la consommation de viande de porc.

Les services vétérinaires souhaiteraient officialiser l'absence des principales maladies porcines : demande pour une « certification » absence maladies majeures dont PPA et PPC. Une étude sérologique est à envisager[2] (avec autres pathogènes à rechercher).

Volailles :

Elevages améliorés et élevages traditionnels.
Importation des oeufs à couver depuis les Pays-Bas (certificats sanitaires) par l'entreprise d'Etat SMB. Production de poussin d'un jour vendus aux éleveurs. Production œufs : 100% de la demande (19 millions par an). Souhait de mettre en place élevages parentaux. Viande importée depuis : France, USA, Brésil, Danemark et Australie, Ile Maurice. Poulet de chair : 60% produit localement (100% possible et souhaité par le Ministère).
Demande des éleveurs : suivis pathologiques, informations plus précises sur origines etc.

Pathologies : actuellement, globalement les mortalités sont inférieures à 6%

- **Maladie de gumboro** (essai vaccinal non satisfaisant) ;
- Suspicion de cas de maladie de **marek** et de **coryza** ;

[1] Dans ce cadre, il a été conseillé de se rapprocher des services vétérinaires réunionnais, ce que pourrait par ailleurs faciliter ce projet régional.
[2] La mise en application des nouvelles règles recommandées par l'Organisation mondiale du commerce dans le cadre des échanges impose de revoir les procédures visant à la déclaration d'un pays comme indemne d'une maladie. Une approche visant à estimer quantitativement, à partir des résultats d'un sondage, le degré de confiance associé à la déclaration d'un pays ou d'une région comme indemne d'une maladie (et plus généralement d'une infection) est nécessaire.

- **Newcastle dans les années 60** ;
- Coccidioses ;
- Problèmes respiratoires non identifiés ;
- Non documentées : salmonelloses, mycoplasmoses.

Carnivores :

Population en augmentation. Population de chiens errants (contrôle par une unité spécifique de la DSV)

- **Rage : jamais déclarée**. Contrôle strict à l'arrivée (quarantaine). Système OIE envisagé (contrôle vaccinal) pour limiter la quarantaine[3].
- Leptospirose fréquente.
- Dirofilariose très fréquente.
- Echinococcose : non rapportée.

Faune sauvage :

Oiseaux dont migrateurs.
Chauve-souris.
Projet d'importations de cerfs de l'Ile Maurice : abandonné
Quelques importations d'oiseaux d'ornements (perroquets).

Autres espèces : lapins. Production marginale, comme pour les autres volailles (canard). Quelques équidés (chevaux et ânes).

3 - SANTÉ PUBLIQUE VÉTÉRINAIRE

La leptospirose semble très importante avec une recrudescence observée depuis plusieurs mois. Politique de contrôle des rongeurs mais souhait de **mettre en place une étude épidémiologique.**

La tuberculose humaine est en augmentation mais il s'agit de tuberculose inter-humaine (*M. tuberculosis*).

Interdiction d'importation de viande bovine depuis la Grande-Bretagne.

La séroprévalence West-nile est très importante (> 50 %) mais il n'y a jamais eu de cas cliniques mis en évidence (syndrome grippal et/ou nerveux pouvant être confondu avec d'autres maladies) cf. publication en **Annexe 5**.

Il est à souligner que l'inspection vétérinaire à l'abattoir (1 abattoir) est effectué par les services de santé publique. Formation des agents pendant 4 ans aux Seychelles avec une partie sur inspection. Spécialisation au Botswana (1 agent) et un en cours actuellement en Grande-Bretagne.

[3] Ce système est également envisagé par l'Ile Maurice

Le laboratoire de l'hôpital de Victoria dispose d'une unité clinique et d'une unité santé publique. Cette dernière pourrait être intégrée au sein du *Seychelles Bureau of Standard* (SBS, cf. infra description) qui effectue les analyses d'hygiène alimentaire. Il n'y a pas d'unité de virologie (mais volonté de mettre en place tests Dengue ; le reste IPM). Contacts rapprochés avec un laboratoire de Singapour (mais coûts élevés).

Le Ministère du tourisme assure l'inspection des hôtels restaurants et les échantillons sont expédiés au laboratoire de l'hôpital.

Pêche : contrôle des produits par un service de la DSV (FIQCU, service vétérinaire pour inspection pêche) et le laboratoire SBS dont une nouvelle construction est prévue prochainement. Les analyses pratiquées par ce laboratoire sont notamment : histamine ; métaux lourds, microbiologie, les pesticides organochlorés. Ce laboratoire dispose de la norme ISO 9002 et est agrée par l'UE pour les contrôles à l'exportation. Est actuellement à l'étude, l'intégration des Seychelles dans un projet régional sur les ressources halieutiques et contrôle sanitaire (projet UE ACP Océan Indien : 6 ACP RPP 458).

4 - SERVICES VÉTÉRINAIRES ET STRUCTURES SANITAIRES

4.1. Structure et moyens

Le Ministère de l'Agriculture (Ile de Mahé) dispose d'une Direction Générale de la santé animale et du développement de l'élevage qui chapeaute une DSV. Les crédits alloués sont relativement peu importants. Il existe un texte de base sur les maladies animales et l'importation des animaux et produits (cf. **Annexe 4**).

4.2. Acteurs

5 vétérinaires sont actuellement en poste : fonctionnaires, il n'y a pas de vétérinaires privés. Un vétérinaire suit actuellement une spécialisation en Australie (pathologie aviaire notamment) et une étudiante est en formation en Malaisie. Un étudiant devrait partir l'an prochain pour un cursus vétérinaire. Recrutement récent d'un vétérinaire malgache depuis septembre 2000. Pas de formations en épidémiologie, excepté stage SADC en Zambie sur maladies transfrontalières (suivi par Dr P. BOUDAN).

Ingénieurs d'élevage et agents techniques (DSV, laboratoire, service de production).

Un centre de formation pour éleveurs existe depuis 2 ans (*Farmers Training Centre*) avec différents modules dont des modules élevage.

4.3. Capacités diagnostiques

- Parasitologie au sein du laboratoire de la DSV. Le technicien du laboratoire de la DSV a suivi une formation à Kabete au Kenya pendant 3 mois mais cette formation est jugée insuffisante.
- Analyses alimentaires (SBS et hôpital) (cf. **Annexe 4**) ;
- Bactériologie médicale possible à l'hôpital.

Surveillance et vigilance épidémiologiques :

Pas de réseaux formalisés mais étant donné les faibles distances, faible population etc., les autorités sont généralement informés rapidement des cas et foyers.
Pas de plans d'alerte ni d'intervention rapide.

Les autres îles (en particulier Praslin) disposent de deux *field officers* et des visites régulières sont organisés par les services vétérinaires de Mahé.

5 - OBSERVATIONS ET SOLLICITATIONS DES AUTORITÉS VÉTÉRINAIRES SEYCHELLOISES

Les contraintes et problèmes soulevés sont les suivants :

- La situation sanitaire excellente fait que peu d'attention est portée à ce secteur ;
- **Les Seychelles ne font pas partie de l'OIE**. L'adhésion à l'OMC est prévue et les services vétérinaires souhaiteraient au travers de ce projet régional approcher l'OIE ;
- **Absence de maladies majeures** mais nécessité de le confirmer pas des techniques de laboratoire
- **Pas de plan d'intervention en cas de suspicion de maladie contagieuse**, et en particulier pour la fièvre aphteuse (FA). Renforcement des contrôles lors de la crise FA en Europe. Les autorités vétérinaires considèrent que l'introduction d'une maladie comme la FA, ou les pestes porcines, serait catastrophique pour l'élevage porcin (de même que les pestes aviaires pour l'élevage avicole.
- **Pas de projet spécifique actuellement dans le domaine de l'élevage**. Dans les années 80, l'AVFP, sur des fonds de la coopération française, a travaillé sur le développement de l'élevage à cycle court et les bovins.

Les demandes spécifiques sont les suivantes :

- **Développement du laboratoire vétérinaire** (santé animale) : équipement et formations (techniciens de laboratoire, épidémiologie) ;
- **Appui pour la définition d'un plan d'alerte** (FA et autres maladies) et révision de la législation sanitaire ;
- **Contrôles des produits de la pêches** : métaux lourds et ciguatera (tests effectués à la Réunion, Ile Maurice) ;
- **Enquêtes sérologiques** pour confirmer l'absence de pathogènes majeurs ;
- Pas d'incinération possible des eaux grasses (ports et aéroport) : demande faite pour l'équipement de 1 ou 2 incinérateurs ;

- Renforcement des contrôles des produits de la pêches (certains métaux lourds et la ciguatera).

6 - RECOMMANDATIONS PRÉLIMINAIRES

6.1. Structuration des services vétérinaires :

- révision de la législation vétérinaire
- adhésion à l'OIE : le rapprochement des Seychelles OIE pourrait être facilité par ce projet

6.2. Formations :

- 1 technicien du laboratoire santé animale
- 1 technicien du laboratoire SBS (bactériologie alimentaire)
- Epidémiologie : formation courtes pour 2 vétérinaires.

6.3. Epidémiologie appliquée :

- Formalisation **d'un réseau de surveillance** ;

- **Fièvre aphteuse : analyse de risque et alerte et plan d'intervention rapide**. Plan d'intervention pour pestes porcines et pestes aviaires.

- **Enquête séro-épidémiologique sur les porcs** : échantillonnage à l'abattoir. Envoi des sérums à La Réunion et Madagascar : PPA, PPC, teschen (IPM), aujeszky (Réunion), leptospirose, cysticercose (IPM).

- **Enquête séro-épidémiologique aviaire**. Situation de la maladie de gumboro (et évaluations des vaccinations) ; newcastle ; marek ; salmonellose et mycoplamoses.

- **Etudes spécifiques** : **leptospirose** (ruminants et porcs) ; **west-nile**. A étudier avec situation dans les autres pays et la possibilité de mettre en place une étude COI avec l'IPM sur ces deux sujets.

- (Echanges avec Ile de la Réunion pour importation géniteurs porcins).

6.4. Laboratoire :

- Installation d'une chaîne **ELISA** au laboratoire vétérinaire.

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SADC : Dans le domaine de l'élevage, les succès les plus flagrant sont enregistrés avec la production sur une grande échelle de porcs et volailles. Des zones spéciales pour l'élevage de porcs ont été créées afin de renforcer la législation sur les déchets et la sécurité. Il y a limite

très stricte pour la production intensive de volailles et les producteurs ont à prouver leur compétences avant d'obtenir une licence. Tous les monogastriques sont nourris par des aliments fournis par l'entreprise parapublique SMB (Seychelles Marketing Board). Le gouvernement seychellois souhaite développer l'élevage bovin pour la production de viande et de lait afin de diminuer les importations. Plusieurs zones ont été identifiées dans le but de développer l'élevage dans d'autres Iles que Mahé. Ces zones sont éloignées des zones touristiques résidentielles et des zones fragiles d'un point de vue environnemental.

7 - REMERCIEMENTS

Je remercie Son Excellence M. le Ministre de l'Agriculture et des Ressources Marines pour son accueil et l'attention portée à cette mission et à ce projet ainsi que M. Alain LE RAVALLEC du Service de Coopération de l'Ambassade de France aux Seychelles. Je tiens également à remercier pour leur accueil chaleureux et leur disponibilité toutes les personnes qui ont contribuées au bon déroulement de cette mission, en particulier le Dr. Bernard MOULINIE, le Dr Jimmy MELANIE, M. Rolland HOARAU et le Dr. Pierre BOUDAN.

ANNEXE 1

DÉROULEMENT DE LA MISSION

DÉROULEMENT DE LA MISSION :

Mardi 26 juin 2001

Arrivée depuis Antananarivo – Madagascar à Victoria - Mahé - Seychelles le 25 juin à 23 :45

Accueil par le Dr B. MOULINIE, Directeur Général de la santé animale (DG *Animal Health and Developpment*).

Entretien avec M. le Ministre de l'Agriculture M. DOLOR ERNESTA, informé de la requête COI dans le domaine de la santé animale, en présence de M. A. LE RAVALLEC, Conseiller SCAC Seychelles, du Dr B. MOULINIE

Réunion de travail avec le Dr B. MOULINIE, le Dr P. BOUDAN, vétérinaire (*vet. specialist*), M. R. HOARAU, Directeur des productions animales , M. G. CHETTY, conseiller technique pour les productions animales auprès du Ministère.

Réunion de travail à la Direction des Services Vétérinaires : Dr. P. BOUDAN, Dr FALY, M. S. LORETTE, assistant élevage, *field work large animals.*

Visite du laboratoire vétérinaire et de la station de quarantaine (carnivores).

Mercredi 27 juin 2001

Visite de fermes avicole, bovine et porcine (Ile de Mahé) accompagné de M. HOARAU.

Entretien avec le Directeur Général de la Santé (*DG Primary Health Care*), Dr P. HERMINIE, accompagné du Dr P. BOUDAN.

Jeudi 28 juin 2001

Visite du laboratoire SBS (Seychelles Bureau of Standards). Entretien avec le responsable, M. J. SHROFF (*Principal Scientist*) accompagné du Dr B. MOULINIE.

Inauguration de la foire nationale agricole : visite avec staff services vétérinaires.

Entretien avec le Directeur des Services Vétérinaires, Dr J. MELANIE

Entretien avec M. A. LE RAVALLEC, Conseiller SCAC, Ambassade de France.

VENDREDI 29 JUIN 2001

Jour férié (fête de l'indépendance). Vol Seychelles – Ile Maurice

ANNEXE 2

PERSONNES RENCONTRÉES

PERSONNES RENCONTRÉES :

- Son Excellence M. Dolor ERNESTA, Ministre de l'Agriculture et des Ressources Marines
- Dr Bernard MOULINIE, Directeur Général de la santé animale et du développement
- M. Alain LE RAVALLEC, Chef du SCAC, Ambassade de France
- Dr Jimmy MELANIE, Directeur des Services Vétérinaires
- M. Rolland HOARAU, Directeur de la section élevage monogastriques
- Dr Pierre BOUTAN, vétérinaire spécialiste (DSV)
- M. Gerald CHETTY, spécialiste élevage
- Dr Patrick HERMINIE, Directeur Général de la Santé
- M. Jude SHROFF, responsable scientifique du Seychelles Bureau of Standards (SBS)
- Dr FALY, vétérinaire (DSV)
- M. Simon LORETTE, agent de terrain (assistant vétérinaire, DSV)
- M. Gustave DELPECH : éleveur (volaille)

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ANNEXE 3

PRÉSENTATION GÉNÉRALE
(DONNÉES DE LA C.O.I.)

SEYCHELLES

PRÉSENTATION GÉNÉRALE (DONNÉES DE LA COI)

1. SITUATION GÉOGRAPHIQUE

L'archipel des Seychelles baigne dans l'océan Indien, à 1 590 kilomètres de la côte est africaine et à 930 kilomètres au nord de Madagascar. Il se situe entre le 4e et le 10e degré de latitude sud et entre le 55e et le 56e degré de longitude est.

L'archipel compte environ 118 îles et îlots pour une superficie de 455,3 km2. Sa zone économique exclusive occupe une superficie de 1,2 millions de km2. . Ces îles sont d'origine montagneuse et granitique, pour une petite partie d'entre elles, et d'origine corallienne, pour le reste.

La capitale est Victoria sur l'île de Mahé.

2. CLIMAT

A 4 degrés sous l'équateur, les Seychelles bénéficient d'un climat tropico-équatorial et subissent l'influence déterminante des moussons. Quatre périodes caractérisent ce climat de mousson :

- une saison fraîche et sèche de la mi-mai à octobre (c'est l'hiver indien),
- une saison humide et chaude de décembre à mars (c'est l'été indien),
- deux périodes intermédiaires d'avril-mai et d'octobre-novembre pendant lesquelles la chaleur est plus supportable.

Tout au long de ces quatre saisons, la température varie peu puisqu'elle n'est jamais inférieure à 25 °C et rarement supérieure à 30 °C. L'humidité atteint souvent un taux de 75 à 80 %.

Les pluies, plus abondantes sur les îles granitiques que sur les îles coralliennes, il en tombe en moyenne sur Mahé 2.276 mm par an. Les précipitations maximales sont observées de décembre à mars, quand la mousson souffle du nord-ouest. Les Seychelles ont par contre la chance de ne pas être concernées par les terribles cyclones de l'océan Indien.

3. HISTOIRE

Les Seychelles, Etat indépendant depuis le 29 juin 1976, l'histoire du pays est marquée par les périodes ci-après :

1770-1811 : Colonisation française
1811-1976 : Colonisation britanique

1976-1977 : 1ère République
1977-1993 : 2ème République
1993-à ce jour : 3ème République

4. SOCIÉTÉ

La population seychelloise est une population métissée : mélange d'Africains, d'Européens et d'Asiatiques. La grande majorité de la population descend d'Africains noirs venus aux îles au cours des deux derniers siècles. Les communautés de souches indo-pakistanaise et chinoise sont très réduites.

Les habitants de l'archipel sont catholiques dans une proportion de 90%. Ainsi, l'Eglise catholique et romaine regroupe 88,6% de la population. L'Eglise anglicane regroupe, elle, un peu plus de 7% de la population. Enfin, les autres rassemblements religieux, tels que les témoins de Jéhovah, les Musulmans, les Hindous etc., représentent seulement 3,4% de la population.

5. ECONOMIE : PRESENTATION GENERALE

Le développement économique atteint depuis l'indépendance (1976) est remarquable. De grands travaux ont été effectués sur les principales îles : construction d'aéroports, d'hôtels, mise en place d'infrastructures et de services publics.

Jusqu'au début des années 80, le secteur agricole occupait une place prépondérante dans l'économie. (40% du PIB et 80% de la population active en 1970). Les principales exportations du pays étaient la cannelle et le coprah. Néanmoins, ces dernières années, l'économie est devenue fortement tributaire du tourisme et de la pêche. Le secteur agricole ne représente plus que 2% du PIB et mois de 10% de la population active.

Les activités touristiques représentent la première source de devises du pays. Alors que le bilan était mitigé en 1994 et 1995, 1996 a vu le secteur touristique repartir et contribuer à hauteur de 61 % au PIB. Le nombre d'arrivées de visiteurs a connu cette année là un record avec 130.955 touristes recensés (80% d'européens). En 1998, 128.258 visiteurs ont été recensés.

Les Seychelles disposent d'abondantes ressources halieutiques dans leur zone économique exclusive. Le pays exploite surtout ses ressources côtières, alors que ses abondantes ressources en thon sont exploitées par des flottilles de pêche étrangères à qui le gouvernement accorde une licence. Le secteur de la pêche occupe une place prépondérante dans l'économie, en tant que source d'alimentation, d'emplois (près de 10% de la main d'œuvre totale) et de recettes en devises.

La production de thon poursuit une progression importante depuis la privatisation de la Conserverie de l'Océan Indien, passant de 7.495 tonnes en 1995 à 18.939 tonnes en 1998.

La production agricole enregistre des résultats positifs. La production de cannelle a progressé, les exportations passant de 487 tonnes en 1995 à 737 tonnes en 1996. La production de coprah est passée de 344 tonnes en 1995 à 395 tonnes en 1996.

Le secteur secondaire (industrie et construction) voit sa contribution au PIB progresser (23,3% en 1998) grâce à l'industrie de conserverie et à la construction.

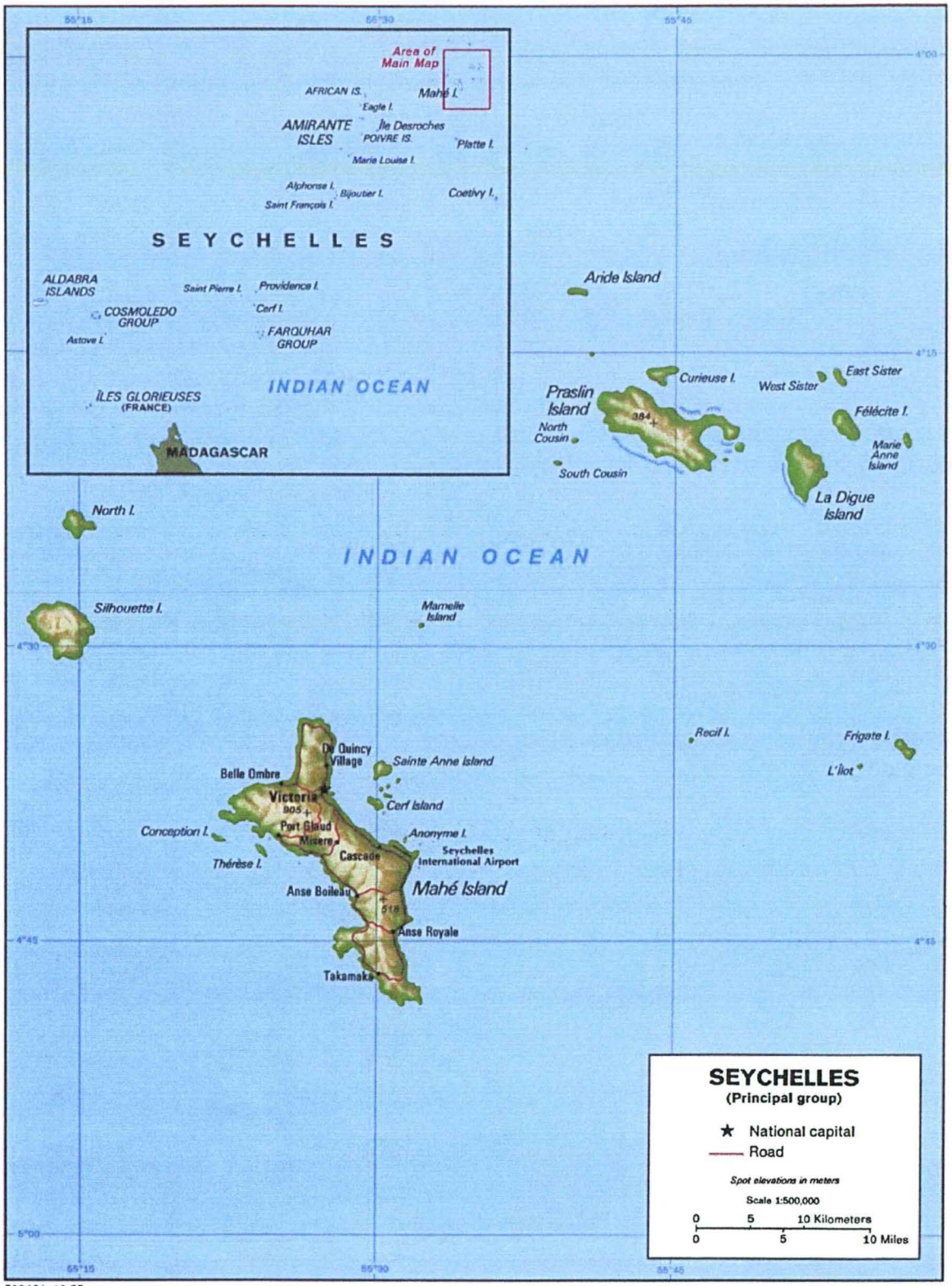
Le secteur transport, distribution et communication qui représente 28,58% du PIB a progressé de 3% en 1996. Les services tels que la distribution, le fret et les activités de stockage ont profité de l'expansion des importations et du tourisme. Le secteur des services financiers a également connu une croissance de 1,3 % avec le démarrage de l'offshore et la libéralisation du secteur des assurances.

6. CONJONCTURE

Après plus d'une décennie de croissance rapide (6% par an), les Seychelles font face à des difficultés financières. La croissance est restée forte en 1997 (4,5%) grâce à la progression des recettes liées au tourisme et à la pêche. En 1998 en revanche, la croissance a été moindre (2,3%) et la situation financière s'est détériorée. Le déficit public (26,2% du PIB) et le déficit de la balance des paiements se creusent (104 millions de dollars en 1998 contre 68 millions de dollars en 1997). Ces déficits sont financés par le recours à l'emprunt, d'où une progression de la dette (34,9% du PIB) et une baisse des réserves qui entraîne une pénurie de devises. Après une inflation quasiment nulle en 1997, les prix à la consommation ont progressé de 3,5% en 1998.

Chiffres clés :

Superficie	0,5 milliers de km2
Population	79.000
PNB/hab.	6 450 dollars (1998)
Croissance	-2,5 % (1997-1998)
Budget éducation	7,9 % du PNB
Serv. dette	5,7 % des exportations
Mortalité infantile	14 pour mille naissances
Espérance de vie	71 ans
IDH	53ème rang mondial sur 174 pays

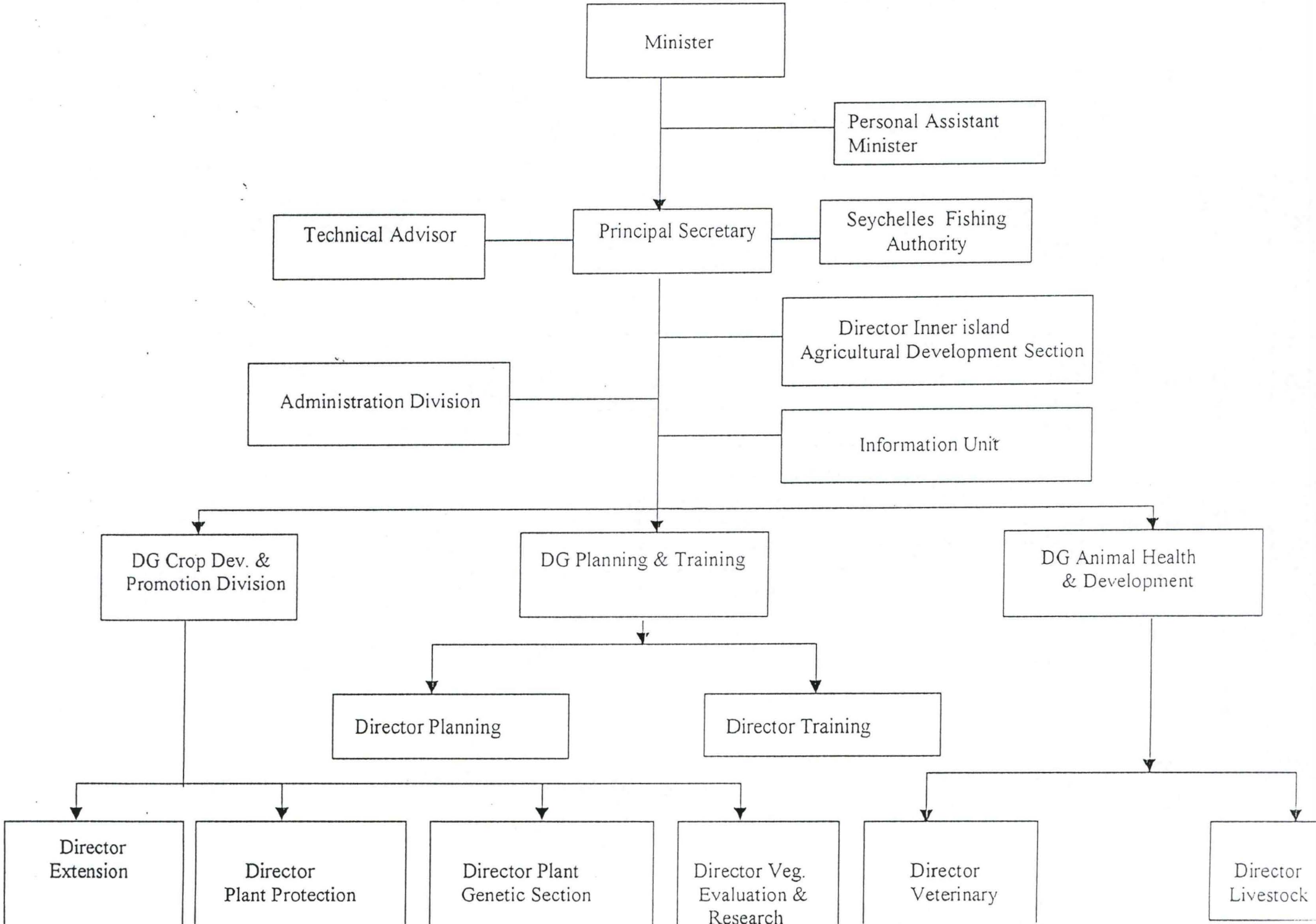

Area of Main Map
AFRICAN IS.
Mahé I.
Eagle I.
AMIRANTE ISLES
Île Desroches
POIVRE IS.
Platte I.
Marie Louise I.
Alphonse I.
Bijoutier I.
Coetivy I.
Saint François I.
SEYCHELLES
ALDABRA ISLANDS
Saint Pierre I.
Providence I.
COSMOLEDO GROUP
Cerf I.
Astove I.
FAROUHAR GROUP
INDIAN OCEAN
ÎLES GLORIEUSES (FRANCE)
MADAGASCAR
Aride Island
Praslin Island
Curieuse I.
West Sister
East Sister
Félécite I.
North Cousin
South Cousin
Marie Anne Island
La Digue Island
North I.
INDIAN OCEAN
Silhouette I.
Mamelle Island
Recif I.
Frigate I.
L'Ilot
De Quincy Village
Sainte Anne Island
Belle Ombre
Victoria
Cerf Island
Conception I.
Port Glaud
Anonyme I.
Cascade
Seychelles International Airport
Thérèse I.
Anse Boileau
Mahé Island
Anse Royale
Takamaka
SEYCHELLES
(Principal group)
National capital
Road
Spot elevations in meters
Scale 1:500,000
0 5 10 Kilometers
0 5 10 Miles
503481 10-77

ANNEXE 4

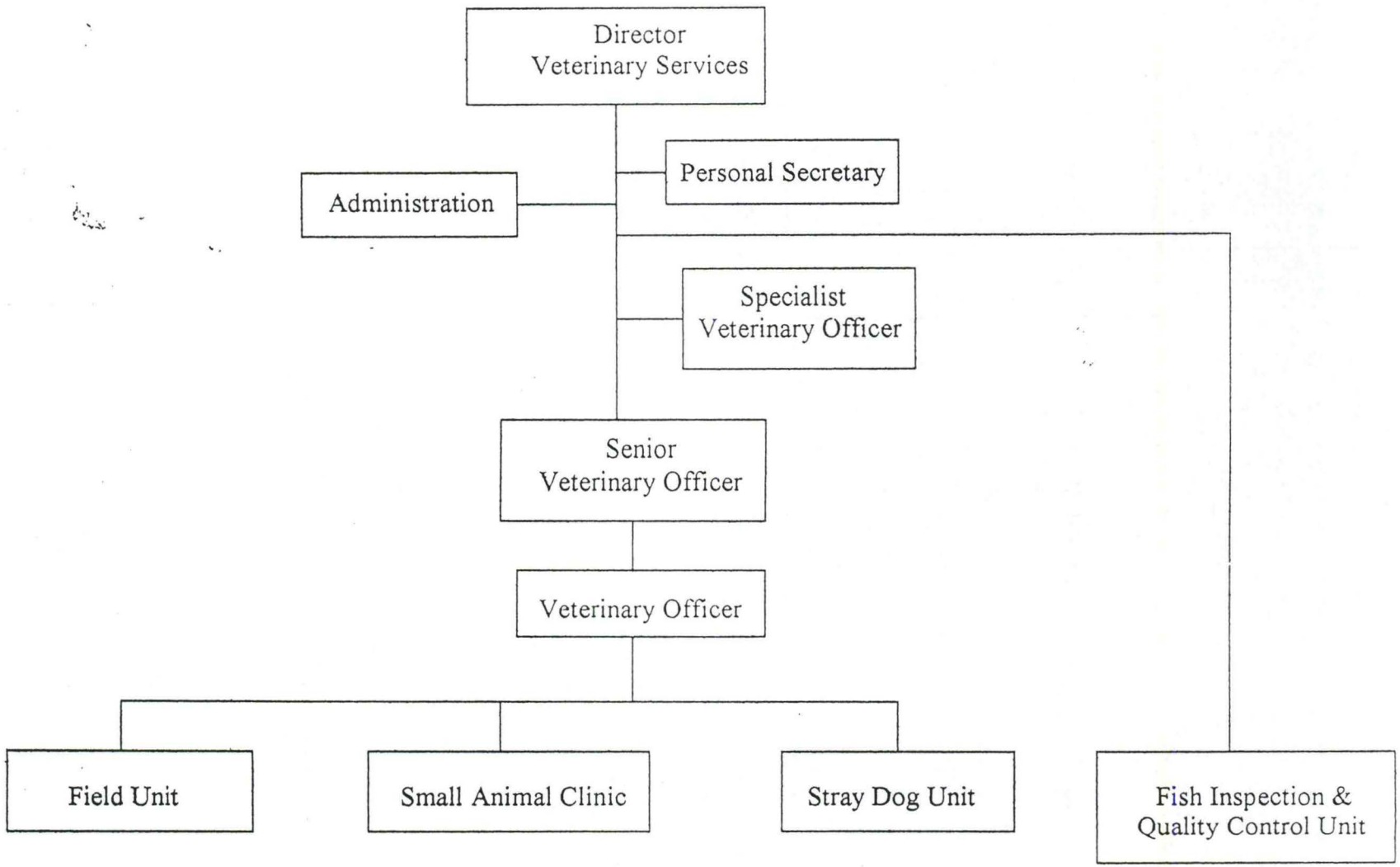
MINISTRY OF AGRICULTURE AND MARINE RESOURCES

- VETERINARY SERVICES
- SEYCHELLES FISHING AUTHORITY
- SEYCHELLES BUREAU OF STANDARDS (LABORATORY TESTING CENTRE)

MINISTRY OF AGRICULTURE AND MARINE RESOURCES

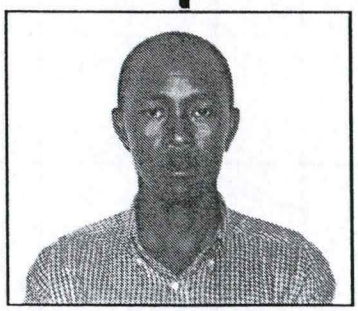


VETERINARY SERVICES
Organisation Chart

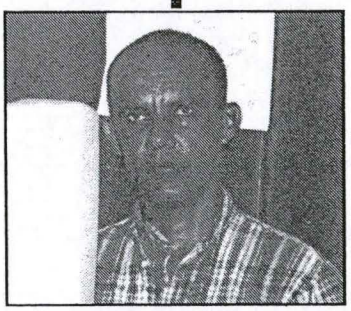


Animal Health & Development Division

Director General: **Dr. B. Moulinie**



Director Veterinary Services :
Dr. Jimmy Melanie



Director Poultry & Cattle :
Mr. Roland Hoareau

Pig Development Section

Livestock Specialist : Mr. Gerald Chetty

Director : Mr. Roland Hoarau

The Pig Development Section comprises of the following units:

1. **The Pig Genetic Centre**
2. **The Pig Monitoring Unit**
3. **The Livestock Extension Service**

THE PIG GENETIC CENTRE

The Pig Genetic Centre's role is to provide all the necessary breeding stock to the licensed breeding centres in Seychelles. Breeding centres are therefore sold F1 blue pigs (females) and pure Duroc boars. This commercial female line is termed as F1, a cross between Large White female (more prolific, better mother) and Hampshire male. However due to a shortage of pure Large White females, in order to maintain the pure breed as well as producing F1 generation, the Large white males are also used on Hampshire females.

Requests have been made in the 2000 budget for a total of R320,000/- for the importation of new blood lines. There are very limited unrelated breeding lines left and if new stocks are not brought in, the Centre will be incapable to meet demand for F1 or even maintain it's different pure lines.

Table 32: Physical performance at the Genetic Centre

Month		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total 1999	Total 1998
Farrowing	Sows	17	9	8	5	13	14	15	23	8	12	16	11	**151**	**117**
	Piglet	141	72	63	38	110	111	128	188	69	99	141	96	**1256**	**1010**
Weaning	Sows	9	15	6	11	6	12	13	13	20	11	11	14	**141**	**115**
	Piglet	61	100	42	66	45	86	93	92	118	84	76	108	**971**	**810**
Services		11	8	19	16	15	10	14	15	14	17	10	9	**158**	**133**
Sales	F1 Gilts	17	9	16	13	11	0	8	0	5	12	0	12	**103**	**104**
	Boars	1	1	2	0	0	0	1	0	2	2	0	1	**10**	**14**
	Fatten	62	51	42	53	44	51	64	43	47	35	77	32	**601**	**466**
	Cull 1	0	3	2	2	0	0	3	1	1	1	1	0	**14**	**17**
	Cull 2	0	0	0	0	0	0	1	0	0	0	7	0	**8**	**17**

Cull 1: piglets with hernia
Cull 2: old stock or culled from breeding stock due to poor performance, physical condition, disease etc.

103 gilts and 10 boars were sold for breeding purposes in 1999. A total of 601 piglets, comprising of castrated boars and female piglets unsuitable for breeding, were sold as fattening stock.

Even though the Centre recorded an increase in the number of farrowing during the year, the output of breeding stock was still lower than 1998. Selection of breeding stock in 1999 was severely affected by poor development of piglets due to acute cases of diarrhoea. During the last few months of 1999, the problem had been contained following a rigorous sanitation practise and closer supervision over the farm. Marked increase in the output of breeding pigs are forecasted for the year 2000.

Table 33: Stock of pigs at the Grand Anse Genetic Centre as at 31/12/99

Breed	Sows	Boars	Replacement		Weaners	Total
			Gilts	Boars		
Large White	27	3	3	0		41
Saddleback	3	0	0	0	0	3
Hampshire	15	3	0	0	7	25
Duroc	28	4	1	2	17	52
Blue Pig	0	0	0	0	83	83
Total	**73**	**10**	**4**	**2**	**115**	**204**

Table 34: Details of quarterly performance

	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	1999Avg.	1998
Born alive per sow	8.0	7.9	8.4	8.6	8.2	8.8
Average mortality per sow (%)	3	3	1.41	4.2	2.9	0.5
Average weaning per sow	6.8	6.9	6.7	7.4	6.95	6.8
Average weight (kg)	6.1	6.2	5.9	6.3	6.1	6.0
Av. age at weaning (days)	n/a	32.8	32.7	33.3	32.9	---
Gestation period (days)	n/a	116	115	116	---	---
Mortality pre-weaning (%)	n/a	12.9	22.6	19.0	18.2	22.5
Repeated services (%)	n/a	2	0	7	3	1

Improvement in number of piglets weaned per sow, weaning weight and a decrease in preweaning mortality were recorded in 1999 as compared to 1998. The months of October to December 1999 recorded the best overall performance for the year.

Table 35: Expenses for stockfeed and drugs (1999)

Value of stockfeed	SR214,127.00
Cost of medecines/drugs	SR7,424.32
TOTAL	SR221,551.32

PIG MONITORING UNIT

The Pig Monitoring Unit is a section under the Pig Development Section that was formed in 1994. This unit organizes all visits pertaining to pig keeping application, complaint cases etc. The Ministry of Agriculture is responsible for providing transport, coordinating all visits and the secretariat for this unit. The cases of illegal pig breeding and fattening in locations considered as residential areas continue to be one of the commonest cause of complaints from the public.

A study was carried out from September to December 1999 to evaluate the number of cases where pig owners who requested for veterinary assistance during this period were either legally or illegally keeping pigs. Table 36 below shows the results of the study.

Table 36: Legal Status of Pig Keepers

Month	Sep.	Oct.	Nov.	Dec	Total
No. of cases attended to	22	19	13	7	61
Permit of Licensed holders	10	11	4	4	29
	45%	58%	31%	57%	48%
Illegally keeping pigs	12	8	9	3	32
	55%	42%	69%	43%	52%

RED MEAT PRODUCTION FIGURES

Table 37 : Slaughtered at the abattoir during the year

	Number	Live weight (kg)	Dressed weight (kg)	Average live weight per head	Average dressed weight per head	RECOVERY RATE
Pigs - Praslin	623	62300	49840	100	80	80%
Pigs - Mahe	5941	534735	427798	90	72	80%
Cattle - Praslin	16	5762	2880	360	180	50%
Cattle - Mahe	132	47034	23517	356.3	178.16	50%

Table 38 : Red meat production - local and imported

	Local (tons)	Import (tons)	Total (tons)	RATIO (%)	
				Local	Import
Pork	477.63	336.53	**814.16**	58.7	41.3
Beef	26.4	489.03	**515.43**	5.1	94.9
Lamb	--	86.19	**86.19**	0	100
Goat	--	19.22	**19.22**	0	100

Table 39: Number of pigs and cattle slaughtered - local beef and pork production and imports for the last three years

		1997		1998		1999	
		Cattle	Pigs	Cattle	Pigs	Cattle	Pigs
On Praslin	No. slaughtered	6	486	16	666	16	623
	Tons	1.08*	38.88*	2.88*	53.28*	2.88*	49.84*
On Mahe	No. slaughtered	87	4597	109	5544	132	5941
	Tons	11.76	317.94	13.47	397.04	23.52	427.79
Subtotal (Local)	No.	93	5083	125	6210	148	6564
	Tons	12.84	356.82	16.35	450.32	26.4	477.63
Imports	Tons	413.9	354.9	459.46	448.2	489.03	336.53
TOTAL	Tons	**426.74**	**711.72**	**475.81**	**898.52**	**515.43**	**814.16**
Meat Ratio	Local	3.0%	50.1%	3.4%	50.1%	5.1%	58.7%
	Imports	97.0%	49.9%	96.6%	49.9%	94.9%	41.3%

* Only the number of pigs and cattle slaughtered on Praslin were available. The tonnage of meat has been calculated based on average weight provided in 1995 and 1996 with a carcass weight of 80 kg for pigs and 180 kg for cattle.

To attain self-sufficiency in pork meat, an additional 4,700 heads of pigs needs to be produced per year.

COUNTRIES FROM WHICH RED MEAT WERE IMPORTED

a). PORK

Pulan Bulan	29,834.90 kg
Australia	91,340.60 kg
Zimbabwe	81,374.00 kg
Denmark	118,727.60 kg
France	15,255.00 kg
Total	336,532.10 kg

b). BEEF

Ireland	444,107.50 kg
Sweden	14,863.35 kg
Australia	30,060.72 kg
TOTAL	489,031.07 kg

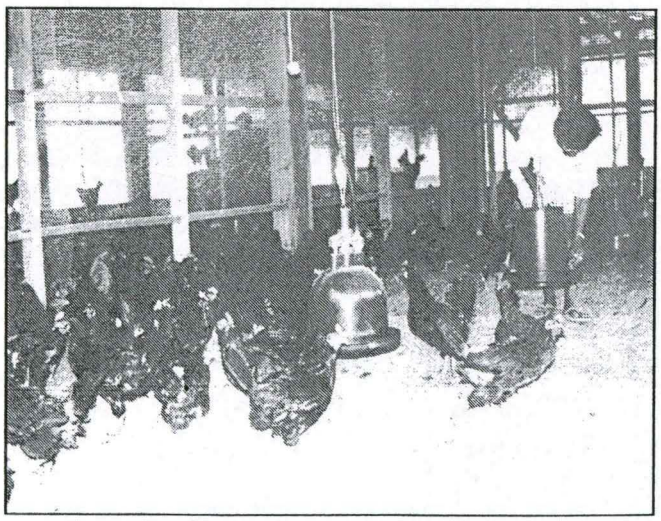
c). LAMB

Australia	62,833.30 kg
New Zealand	23,353.00 kg
TOTAL	86,186.30 kg

LIVESTOCK EXTENSION SERVICE

The Livestock Section does not have an extension service, however the officers based at Union Vale incorporate such a service with other responsibilities. All licensed poultry farms, licensed pig breeding farms and pig fattening farms are visited on a regular basis. Presently 52 poultry farms, 31 pig breeding farms and a large number of pig fattening farms are in operation in the country.

Emergency visits are also carried out at farms that register problems with diseases or high mortalities of stock.

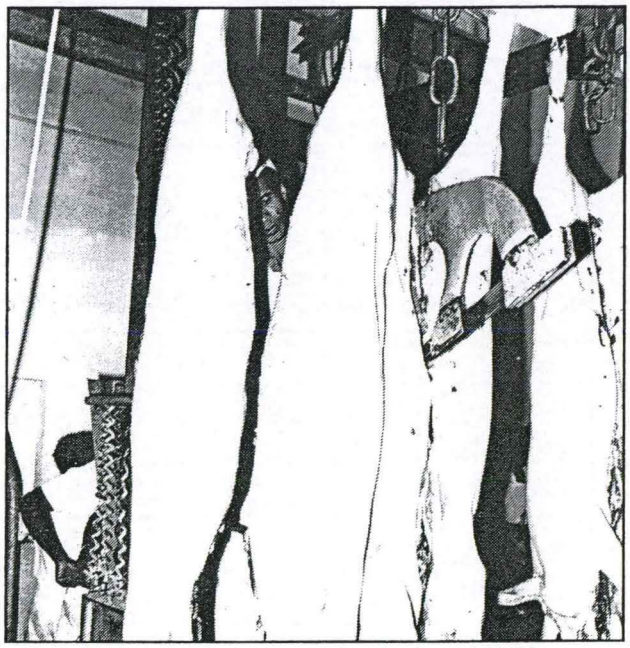


A poultry farm

d). GOAT

New Zealand	19,223.30 kg

Note: All import figures were extracted from Landing Permits issued by the Veterinary Services to the Seychelles Marketing Board.



REVENUE

Revenue from the sale of milk, pigs, cattle and manure brought in R450,000/- during 1999.

STAFF MOVEMENT

Mr. Conrad Mounac was employed on 15/11/99 as Field Assistant, and is based at the Pig Genetic Centre at Grand Anse Mahe.

STAFF TRAINING

OVERSEAS TRAINING

Mr. Roland Mein attended a five- week training program during the month of August

to September in Germany entitled "Urban and Peri-Urban Animal Production in the Tropics and Sub-tropics" ; fully funded by the Federal Republic of Germany.

Mr. Vincent Alcindor attended a four-month training program in Japan from January to April entitled "Swine Production and Breeding Technology"; fully funded by the Japanese International Cooperation Agency.

Miss Jane Otar and Mr. Roland Hoarau attended a two-week training in Mauritius during October in the field of Cattle Production and Diagnosis of Poultry Diseases respectively; partly funded by the Mauritius Government.

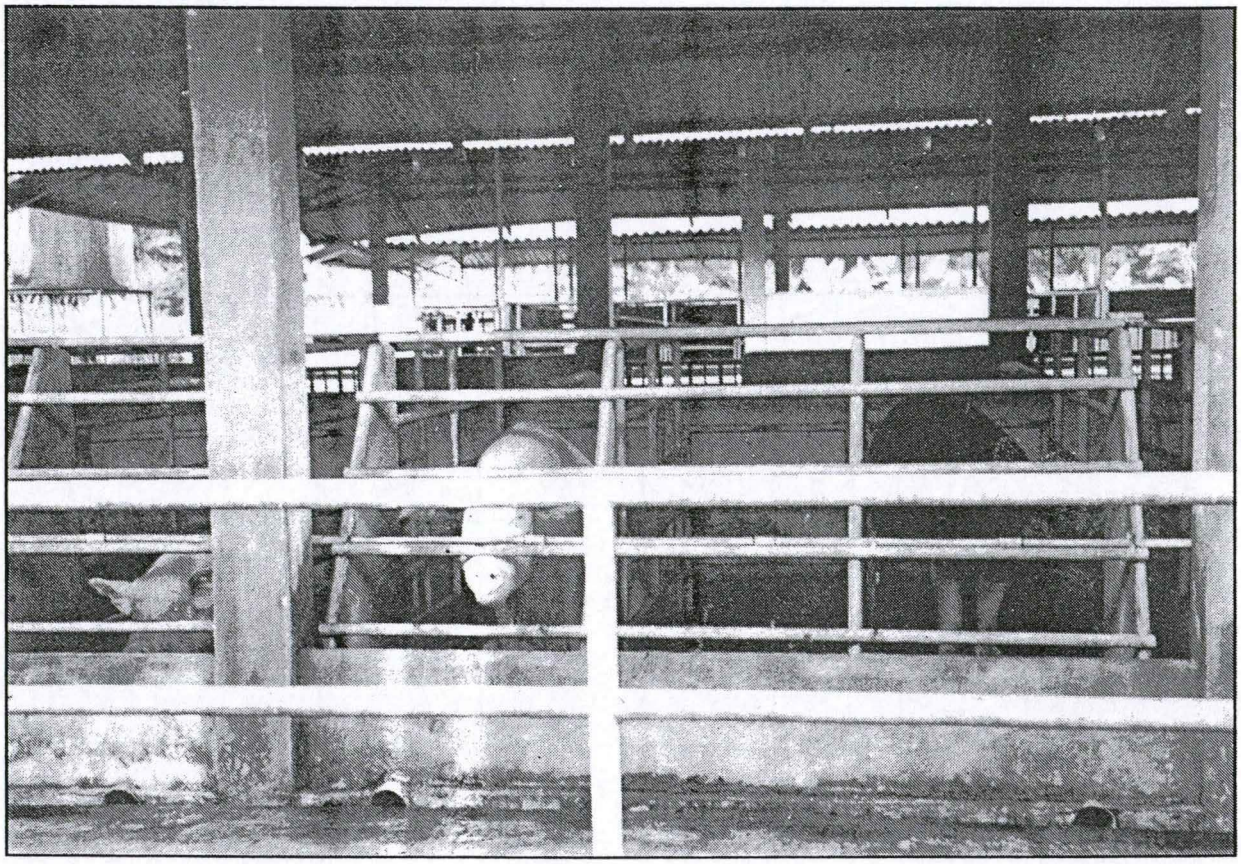
LOCAL TRAINING

Miss Claudette Azemia attended a beginners course in computing in October for three days at S.I.M.

CONCLUSION

In 1999 the production of chicken meat and eggs have been stable. An increase in pork production, both quality and quantity wise, were apparent and no major disease affected livestock production.

Where the Ministry's livestock farm and it's activities are concerned, performance can also be termed as satisfactory. However, there is much room for improvement.



A piggery

Poultry & Cattle Section

Director : Mr. Roland Hoarau

The Poultry and Cattle Section comprises of 2 units, namely :

1. **The Poultry Unit**
2. **The Cattle Multiplication Centre**

THE POULTRY UNIT

The main role of this unit is to advise all poultry producers, especially through its extension services. The unit is made up of the broiler industry and the layer industry.

THE BROILER INDUSTRY:

Broiler production is carried out by the private sector, this comprises of ten commercial farms with nine on Mahe and one on Praslin. All finished broilers on Mahe are slaughtered at the SMB abattoir, and the farm on Praslin has its own private abattoir. L'Union Estate on La Digue and IDC also produce some broilers, for self-consumption and therefore are not regarded as commercial operations.

Table 40:Broiler Farms Performances

FARMS	Live weight per birds (kg)			Average carcass weight per bird (kg)	Average days at slaughter	Mortality (%)
	Highest	Lowest	Averag			
Mahe Farming	2.3	1.79	2.05	1.59	45	6.3
L'Exile Farm	2.14	1.91	2.02	1.5	44	11.1
Morin / Adeline	2.16	1.93	2.06	1.56	43	8.1
Sydna Pothin	1.77	1.38	1.66	1.24	42	15.6
Richard Pillay	1.97	1.69	1.85	1.4	43.5	7.9
Michel Lautee	2.14	1.85	2.05	1.54	45	8
Andre Uzice	2.43	1.93	2.16	1.62	46	7.5
Michel Pillay	2.07	1.76	1.93	1.47	43	9.2
Guy Moustache	2.16	1.86	2.02	1.53	44	9.3

Table 41: Yearly average performance of local broiler production (1997-1999)

Year	Live weight per bird (kg)	Carcass weight per bird (kg)	Days at slaughter	Mortality (%)	Average daily live weight gain
1997	1.94	1.48	43.7	8.7	43.4
1998	2.02	1.54	44.4	9.8	44.5
1999	2.05	1.56	43.9	9.2	45.6

Above figures reflects the continuous improvement in performance of broiler production. This has been achieved due to the strict control enforced by the Livestock Section, the experience of the producers and the mechanization of feeding, drinking and ventilation systems at the larger farms. The live weight in relation to age at slaughter and the average daily live weight gain can be compared to production level in developed countries.

Table 42: Abattoir : Throughput for the year

Month	Birds slaughtered	Live weight		Dead on arrival		Condemned			Dressed weight		Recovery rate %
		Total	kg/ bird	No.	kg	No.	kg	Parts	Total	kg/ bird	
Jan.	50958	104893.5	2.06	71	142.5	34	31	139.6	79507.5	1.56	75.97
Feb.	56986	111238.5	1.95	98	180.5	54	41.9	124.2	84437.1	1.49	76.1
Mar.	57222	110673.6	1.93	210	400.3	69	60.3	182.4	83666	1.47	75.98
Apr.	62923	125323.1	1.99	94	168.1	85	70.6	181.8	97201.1	1.55	77.76
May	48962	92938.5	1.9	81	145.3	55	44.7	176.6	70699.8	1.45	76.3
Jun.	64028	132802	2.07	43	81.7	145	132	216.4	101253	1.58	76.44
Jul.	59666	124996.6	2.09	47	85.9	196	216.6	183	93867.5	1.58	75.33
Aug.	56006	123016.5	2.2	45	95.2	44	48.7	227.4	92106.5	1.65	75.03
Sep.	58837	124367.9	2.11	81	150.2	134	131	210.8	92845	1.58	74.88
Oct.	57445	117015.9	2.04	45	87.3	57	54.8	171.4	89125.3	1.55	76.31
Nov.	63440	130442.2	2.06	145	296.6	68	59.3	216.2	99751.3	1.58	76.74
Dec.	58356	125793.6	2.16	76	157.8	63	64.7	290.6	95364.6	1.64	76.03
Total	**694829**	**1423510.9**	**2.05**	**1036**	**1991.4**	**1004**	**955.6**	**2320.4**	**1079824.4**	**1.56**	**76.07**

Condemned: Extensively bruised chicken or bruised/broken body parts.
Dressed weight: Weight of chicken after de-feathering and evisceration.

Table 43: Local production and imports over the last three years

		1997	1998	1999
Praslin	No. slaughtered	53591*	52041*	55759
	Tons	75.03**	72.86**	78.06**
Mahe	No. slaughtered	812835	682780	694839
	Tons	1187.5	1054.3	1079.84
Subtotal Local	No.	866426	734821	750598
	Tons	1262.53	1127.16	1157.9
Imports	Tons	144.1	348.3	300
TOTAL	Tons	1046.63	1475.46	1457.9
Ratio	Local (%)	89.8	76.4	79.4
	Import (%)	10.2	23.6	20.6

As all finished broilers on Mahe are slaughtered at the SMB abattoir, the figures of production are accurate.

* Praslin production: Number of chickens slaughtered in 1997 and 1998 are based on the number of day old chicks supplied by the hatchery, allowing for 8% mortality. 1999 figures are actual number of birds slaughtered, figures in this case were supplied by the Health Inspector's Office, responsible for meat inspection on Praslin.

** Carcass weight calculated at an average of 1.4kg per bird.

Importation of chicken meat in 1997 was only 144.10 tons. This was due to SMB stopping all importation from July to December in that year in order to clear some 150 tons of buffer stock that had accumulated in the cold store.

Local production in 1998 and 1999 were lower than in 1997 due to the SMB hatchery enforcing a stricter control on the quota system. In 1997 there were a high surplus of day old chicks produced by the hatchery which were thus sold to the broiler farmers.

IMPORTING COUNTRY AND QUANTITY 1999 (POULTRY MEAT)

a) CHICKEN

Brazil	155,486.87 kg
Denmark	135,651.20 kg
Australia	8,880.00 kg
Total	**300,017.07 kg**

b) TURKEY

France	9,007.0 kg

c) DUCK

France	1,296.0 kg

Table 44: Sales of day old chick for the past three years

Year	Layers			Broi-lers
	Nera	B.W.L	Total	
1997	48,814	19,204	68,018	898106
1998	72,285	17,156	89,441	830601
1999	65,773	14,171	79,944	857780

THE LAYER INDUSTRY :

Nera is a blackish layer chicken that produces brown eggs that are most favoured locally whereas White Leghorn is completely white with white-shelled eggs.

All broilers produced are of the Cobb type, this was introduced in 1991 and performance has been very satisfactory.

Estimated egg production for 1999 is at 19.15 million or 957.5 tons. The following formula is used to work out the egg output.

i) Number of layer day old chicks sold by the hatchery
ii) Mortality over rearing period at 10%
iii) Average laying percentage 70%
iv) Point of lay at 22 weeks
v) Rearing period of 72 weeks

Table 45: Estimated egg production

1999	Stock of layers	Mortality 10%	Birds in lay	Eggs per day	Eggs per month
Jan	76,367	7,637	68,730	48,111	1,491,441
Feb	76,376	7,637	68,730	48,111	1,347,108
Mar	80,108	8,011	72,097	50,468	1,564,505
Apr	75,039	7,504	67,535	47,275	1,418,235
May	87,797	8,780	79,017	55,312	1,714,669
Jun	87,810	8,781	79,029	55,320	1,659,609
Jul	89,441	8,944	80,497	56,348	1,746,785
Aug	89,441	8,944	80,497	56,348	1,746,785
Sep	81,880	8,188	73,692	51,584	1,547,532
Oct	82,732	8,273	74,459	52,121	1,615,760
Nov	82,389	8,239	74,150	51,905	1,557,150
Dec	89,040	8,904	80,136	56,095	1,738,951
Total	**998,420**	**99,842.1**	**898,569**	**628,998**	**19,148,530**

The egg production industry is very stable and self-sufficiency in this sector has been achieved for the last fifteen years. During the last ten years the sizes of several farms have increased along with the closure of small farms with stocks of 200 to 500.

APPLICATION FOR LAYERS LICENSE

Thirteen new applications for layer production and four requests for extension of actual licenses were made to the Livestock Section this year. Out of these, three new applications and the four requests for extension were approved subjected to the necessary regulations from the different Ministries which are involved, one case is still pending.

The applications that were turned down (nine applications) were due to the project being in areas considered for residential development.

The low price of eggs towards the second half of the year has discouraged entrepreneurs from venturing into the egg producing business.

All applicants are also advised as to the cost of setting up such an enterprise, the risks involved and the marketing constraints they may face.

POULTRY HEALTH

Only five cases of abnormal mortality were reported to the Livestock Section in 1999. A case of Gumboro (viral disease) a case of Coccidiosis (protozoan disease), but the cause of the other three cases could not be confirmed.

Post mortem examination are carried out on all diseased chicken which are brought to the Livestock section, as no laboratory tests are carried out only clinical findings are depended upon for a conclusion.

The local poultry industry is of major economic importance to the country given the financial factors that involves around this enterprise. This starts with the importation of hatching eggs, the functioning of the hatchery and feed mill, the costs incurred by farmers to purchase feed and chicks, the production and marketing of eggs, the abattoir's operation, the marketing of poultry meat and it's product, not forgetting the output of manure from these farms which are the main medium used in crop production.

This is why such an industry should be safeguarded; one of the main necessity is to set up a livestock diagnostic laboratory with trained personnel to manage such. This will help in the identification of diseases to a certain extent and so provide a much needed service to the farmers.

Given this country's limited land area, a highly contagious disease, if not identified and contained on time, could wipe out the whole industry in a short period. The availability of basic drugs such as dewormers, antibiotics, coccidiostats and vitamins are also of great importance.

Further training of personnel within the Ministry involved in poultry production is also essential.

Cattle Multiplication Unit

The primary role of the Cattle Multiplication Unit at Anse Royale is to produce superior breeds of cattle of the Brown Swiss origin for sale to the farmers. Bull semen were imported and artificial insemination were carried out at the Cattle Unit with it's actual local breeds (a mixture of various breeds introduced over the years). The AI program was also carried out at some private farms.

However, the AI program grounded to a halt during the latter part of 1996 due to the constraint beyond the control of the unit. The cattle produced from the farm are now crosses from the existing breeds and a considerable amount of inbreeding is unavoidable. The demand of cattle for rearing purposes is very high and by far surpasses supply.

All milk produced is sold, whereas most manure is transferred to other farms within the Ministry. Demand of manure from the public and other Ministries are quite high now that the beautification campaign of the country have really taken off.

During the year, Anse Royale Farm has encountered major constraints in the maintaining and replanting of the elephant grass plantation. The limited fuel and fertilizer budget, the breakdown of the slurry pump along with the severe drought were all factors that culminated to the unsatisfactory performance where elephant grass is concerned.

Table 46: Performance for the year

Month	Calving	Weaning	Milk yield (litres)	Sales		
				Milk	Calves	Culls
Jan	4	1	2,724.0	2,482.0	1	2
Feb	3	7	1,912.5	1,837.5	1	0
Mar	0	5	2,903.5	2,507.5	2	0
Apr	5	2	2,690.5	2,430.5	4	0
May	3	1	2,584.0	2,474.0	1	11
Jun	2	1	1,967.5	1,967.5	3	0
Jul	11	3	2,025.5	2,022.5	3	0
Aug	5	5	1,921.0	1,921.0	1	0
Sep	5	1	1,829.5	1,829.5	0	0
Oct	6	2	2,188.5	2,139.5	1	0
Nov	4	5	2,958.5	2,336.0	3	5
Dec	2	3	2,955.0	2,479.0	3	0
Total'99	50	36	28,660.0	26426.5	23	18
Total'98	52	42	29069.0	27,371.0	25	15

The performance for 1999 is slightly lower than that of 1998.
A value of R267,264/- worth of cattle feed concentrates was spent for the year.

Veterinary Services Section

Director : Dr. Jimmy Melanie

The performance of Veterinary Services for 1999 was satisfactory. All the units: Clinic, Field Unit, Fish Inspection and Quality Control Unit and Stray Dog Control Unit worked together and no major disease outbreak was reported and remarkable improvements in all the fish processing establishments were evident.

The unit, which showed most progress during the year, was the Fish Inspection and Quality Control Unit (FIQCU). It is now well equipped and the personnel are adequate to cope with the increase in export, to apply the EU Directives on Fishery Products and to maintain its status as a Competent Authority.

SMALL ANIMAL CLINIC

A total of one thousand seven hundred and seventy-one (1771) cases compared to one thousand seven hundred and fifty-two in 1998 were recorded in 1999.

As it has been the case over the years, most of the patients were dogs (one thousand five hundred and fifty -1550), followed by cats (two hundred and fourteen - 214) and others - tortoise, rabbit and guinea pig (seven – 7). This represents a slight increase of 1% over the previous year.

Medical and surgical treatments, prophylaxis, post-mortem examination, quarantine control, laboratory analysis, the issuing of Veterinary Health Certificates, Imports and Landing Permits were the main activities carried out.

Table 47: Cases Recorded In 1999

Animals	No. of Cases	Percentage
Dogs	1550	87.5%
Cats	214	12.1%
Others	7	0.3%
Total	1771	

MEDICAL CASES

Musculoskeletal conditions (lameness) as a result of traumatism (Road Traffic Accident, fights), jaundice in puppies 3-4 months old, dermatitis of multiple origin, otitis, gastro-enteritis, cardiovascular complications, intoxication/poisoning, respiratory tract infection and urogenital conditions were the main pathological disorders encountered.

SURGICAL CASES

Major surgical interventions consisted of sterilisation, caesarean section, fracture reduction, leg amputation, tumour excision whilst minor surgeries included wound dressing and cosmetic surgery.

LABORATORY ANALYSIS

Basic parasitological analysis was carried out mainly on stool and blood samples with intestinal worms and microfilaria (heartworm) being the main findings.

Table 48: Sterilisation Records

ANIMALS	CASES
Bitches	103
Dogs	62
Queens	49
Tomcats	47
TOTAL	261

PROPHYLAXIS

Heartworm disease prevention and immunisation of dogs especially against Leptospirosis continue to be our main prophylactic activities.

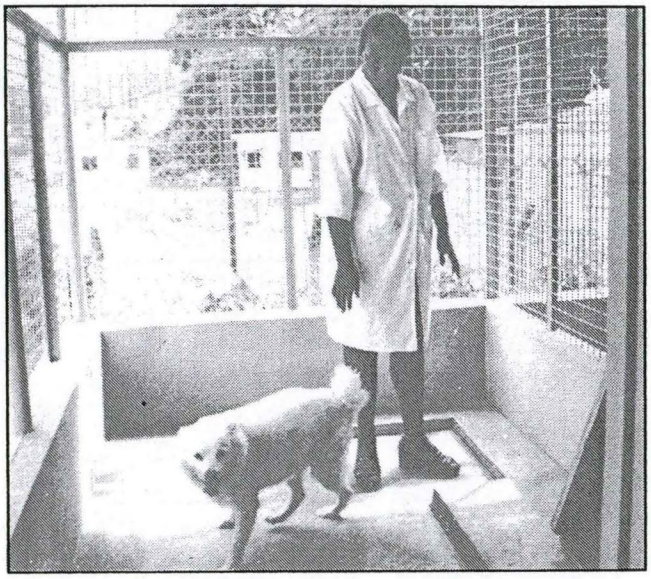
QUARANTINE ACTIVITIES

The quarantine of animals and animal products is one of the responsibilities of the Veterinary Services so as to prevent the introduction of unwanted organism into the Seychelles. As in 1998, the majority of quarantine in 1999 was pets. One case of illegal entry (a tortoise) was reported, as shown in table 49.

Table 49: Quarantine Activities

TYPE OF ANIMALS	NUMBER
Dog	30
Cat	1
Duck	6
Parrot	1
Guinea Pig	1
Tortoise	1
TOTAL	40

The new Quarantine Station became operational during the 4th quarter of the year and has catered for thirteen (13) animals and SR13075.00 (thirteen thousand and seventy-five Seychelles Rupees) has been collected as revenue.



Part of the new animal quarantine building

Australia, France, U.K, South Africa, Switzerland, U.S.A, Italy, Madagascar, Finland, Bahrain and Mauritius were the main exporting countries.

VETERINARY CERTIFICATES

Officially certificates covering the exportation of two (2) tortoises, one (1) dog and one (1) cat were issued.

VETERINARY HEALTH CERTIFICATES

Twelve (12) certificates for meat and meat products namely pork sausages, salted pork, crackling and black pudding, were issued to individuals travelling abroad.

IMPORT AND LANDING PERMITS

Permits were issued for the importation (S.M.B and non-commercials) and transhipment of meat and meat products. Ireland, Zimbabwe, South Africa, New Zealand, France, Australia, Singapore, U.K and Denmark were the main countries from which imports were effected.

FIELD UNIT

Presented in table 50, is the number of cases recorded by the Field Unit.

Table 50 : Cases Recorded by Field Unit

SPECIES AFFECTED	NO. OF CASES
Pig	779
Cattle	237
Goat	55
Tortoise	9
Horse	5
Rabbit	1
TOTAL	1,086

An increase of 10%, from nine hundred and eighty-four (984) in 1998 to one thousand and eighty-six in 1999 was recorded.

PIGS

Diarrhoea in piglets continued to be a problem followed by post-partum conditions (mastitis, metritis, agalactiae), lameness and wound dressing.

Only forty-five (45) boars were castrated due to unavailability of anaesthetic and illegal breeding continues to be the source of increase demand for boar castration.

CATTLE

Over the years the population of cattle has dwindled and last year only thirty-two (32) cows compared to fifty-four (54) in the previous year were issued with slaughter permit. This represents a notable decrease of over 40%.

Retained placenta, mastitis, vaginal prolapse, digestive disorders, parasitism and nutritional deficiencies were the main problems encountered.

GOATS

Goats were seen mainly for digestive conditions, parasitism and traumatism resulting from dog attacks. During the year an increase number of attacks on goat by pack of dogs was reported.

Tortoises were mostly treated for traumatism, whilst lameness and digestive disorders were the main complaints with horses.

FISH INSPECTION AND QUALITY CONTROL UNIT (FIQCU)

Fish Inspection Laboratory financed by the African Development Bank was completed during the first quarter of the year and the unit is now situated at the Fishing Port where most of the fishing activities are concentrated.

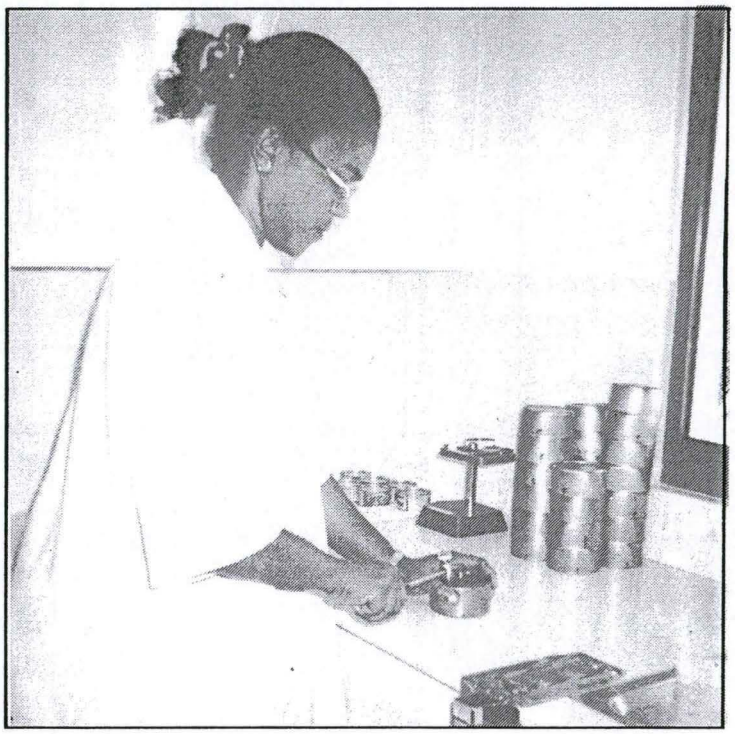
The help of a Fishery Advisory Consultant was obtained, the unit now has its own Secretary, a Chief Fish Inspector and in line with EU evaluation mission's recommendation, an Assistant Laboratory Technician was recruited and computer training was organised.

Audit of fish processing establishments: Indian Ocean Tuna, Oceana Fisheries, Sea Harvest and Coetivy Prawn Farm, inspection of tuna fishing vessels during unloading and transhipment, organoleptic assessment and seam evaluation of canned tuna, histamine, mercury and water analysis were the main activities carried out.

An increase of 14% in the number of certificates issued was observed, from three thousand six hundred and eighty-six (3686) in 1998 to four thousand two hundred and twenty (4220) in 1999.

Table 51: Export Figures For Fish And Fish Products

PRODUCTS	AMOUNT (Tons)
Fresh Fish	756
Frozen Fish	107
Frozen Prawns	160
Transshipment (Brine Tuna)	65,578
Canned Tuna	37,507
Fish Meal	2,213
Non-commercial	45
Tuna Loins	1,337



Quality Officer at work at the new FIQCU premises

STAFF MOVEMENT

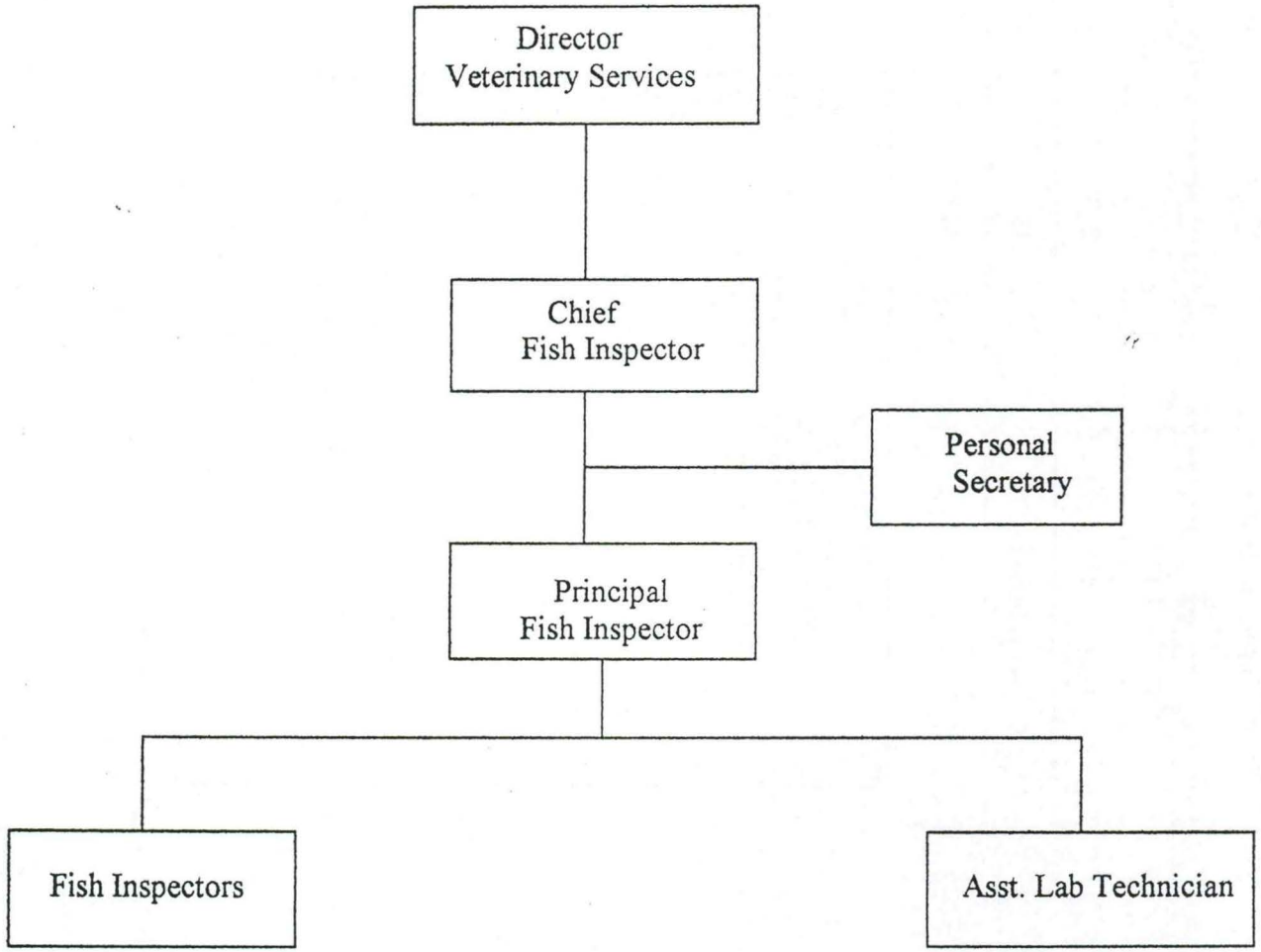
During the month of December 1999, Dr Jimmy Melanie was promoted to Director Veterinary Services. Dr Pierre Boudane, the former Director took the post of of Veterinary Specialist.

TRAINING

The Chief Fish Inspector attended a local course on "Applied Statistic For Scientific and Industrial Laboratories", and a workshop in Marine Eco-Toxicology in Reunion.

Veterinary Services was informed during the course of the year that the Seychelles has been recognised as per Council Decision 1999/245/CEE (JOCE L9) to export Fishery and Aquaculture Products to EU markets.

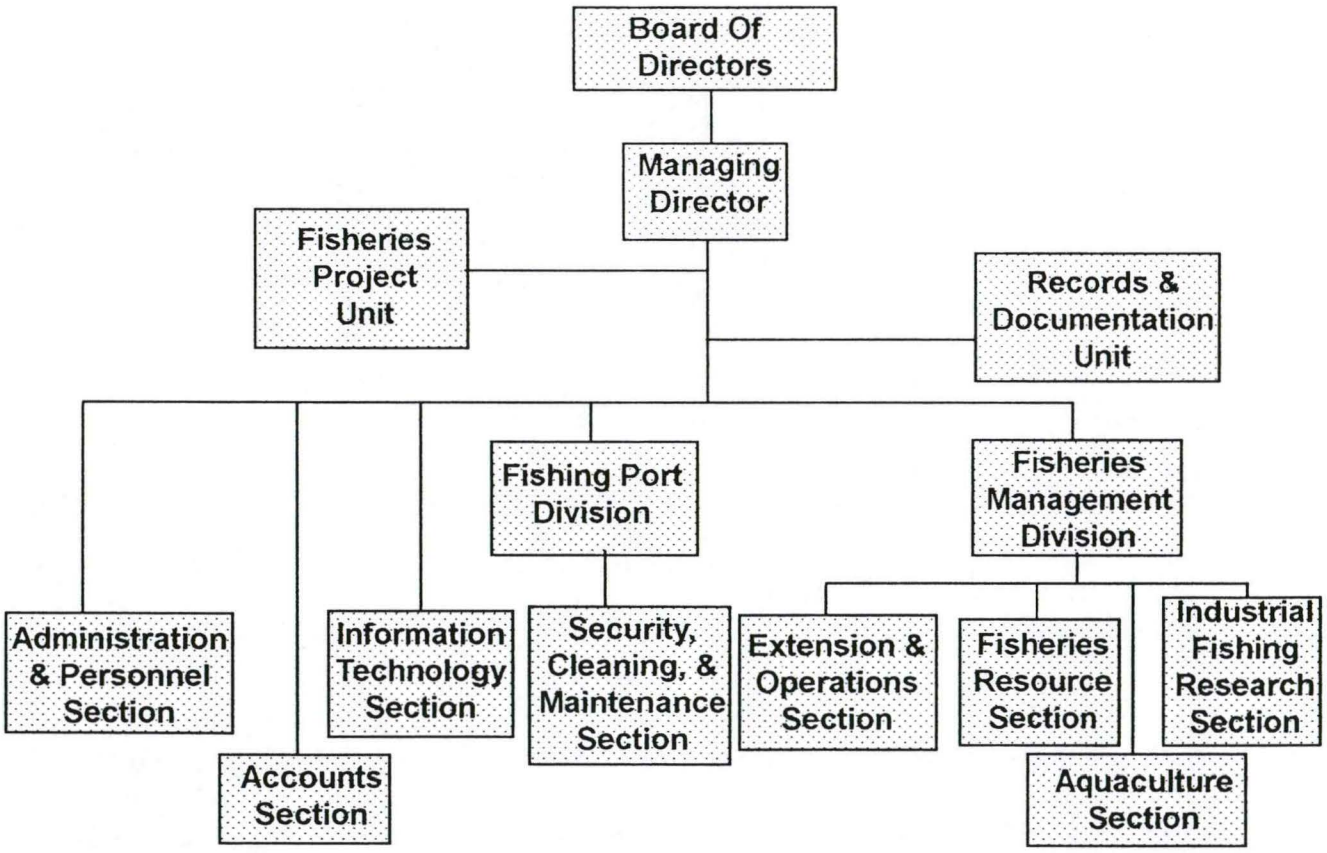
FISH INSPECTION AND QUALITY CONTROL UNIT
Organisation Chart



Seychelles Fishing Authority

Managing Director : Mr. Phillip Michaud

STRUCTURE OF SFA



SFA was incorporated on 31st August 1984 by the Seychelles Fishing Authority (Establishment) Act, although it had physically been in existence since September 1983 when the Seychelles Industrial Fishing Authority (SIFA) was formed with appointment of Mr. Maxime Fayon as Executive Chairman. The Authority was established at a time of intense development especially in foreign industrial tuna fishing. It was created to develop the fishing industry to its fullest potential and to safeguard the resource base for sustainable development. It absorbed personnel from the defunct

FOOD MICROBIOLOGY

TESTS	MATRIX	COST(Rs)
Feacal streptococcus	Water	100.00
Presumptive E. coli	Water	100.00
Pseudomonas aeruginosa	Water	100.00
Spores of anaerobes, Clostridia	Water	100.00
Thermotolerant coliform	Water	100.00
Total coliform	Food, animal feed & water	100.00
Total aerobic plate count	Food, animal feed & water	100.00
Staphylococcus aureus	Food and animal feed	100.00
Salmonella	Food and animal feed	160.00
E. coli	Food and animal feed	100.00
Yeast and mold	Food and animal feed	100.00
Bacillus cereus	Food and animal feed	100.00
Clostridium perfringen	Food and animal feed	100.00
Total coliform	Milk & Milk Products	100.00
Lactobacillus bulgaris	Milk & Milk Products	100.00
Streptococcus lactis	Milk & Milk Products	100.00
Evaluation of air microflora	Air	100.00
Evaluation of surface microflora	Surface	100.00

* All prices are per sample tested

ISO 9002
TRADA CERTIFICATION
APPROVED QUALITY SYSTEM
NATIONAL ACCREDITATION OF CERTIFICATION BODIES

Certificate No : 524

Further Information, Contact:
Mr. Jude Shroff
Laboratory Testing Centre
Seychelles Bureau of Standards
PO Box 953, Victoria
Tel: 375-333 Fax: 375-151
Email: sbsorg@seychelles.net

SEYCHELLES BUREAU OF STANDARDS

Laboratory Testing Centre

Testing Services Offered in the

FOOD PRODUCTS LABORATORY

LTC MISSION AND OBJECTIVES

The laboratory Testing Centre (LTC) has the principal mission of providing laboratory-testing services, consultancy services in science and technology and executing applied science projects. The main objective of the LTC to accomplish its mission is to provide these services both to the government and private organisations. There is a wide range of services offered in the LTC from the various laboratories that have been set up. The Food Products Laboratory is one of the seven laboratories, which forms part of the LTC.

FOOD PRODUCTS LABORATORY

Testing facilities offered in this laboratory are vital to producers and manufacturers of chemical and agricultural products. Many food products such as milk, canned tuna, beverages and jam are tested regularly as quality check exercises and upon requests from our clients either to ascertain end product quality or as general information needed for processes.

HUMAN RESOURCES AND EQUIPMENT

Competent analysts in the field of food chemistry and microbiology manage the Food Products Laboratory. Due diligence is practiced to obtain reliable results and confidence in test results is ensured by statistical application as well as the use of Standard Reference Materials. The laboratory is geared up with various laboratory equipment, which are required to perform the tests. The expertise of the analysts is required to operate and maintain the equipment in proper working order.

FOOD CHEMISTRY

CHEMICAL TESTS	MATRIX	COST(Rs)
FISH/FISH PRODUCTS		
Defects (Taint, decomposition)	Canned tuna	60.00
Percentage honeycombing	Canned tuna	60.00
Pack declaration (Solid, chunk)	Canned tuna	60.00
Net and drained weight	Canned food	60.00
Histamine	Canned tuna, raw fish	160.00
Metal analysis (Mercury)	Raw fish, prawns, canned tuna	300.00
Metal analysis (lead)	Raw fish, prawns, canned tuna	300.00
Metal analysis (cadmium)	Raw fish, prawns, canned tuna	300.00
Metal analysis (Selenium)	Raw fish, prawns, canned tuna	300.00
Chloride content (NaCl)	Raw fish	100.00
MILK AND DAIRY PRODUCTS		
Fat content	Cheese	85.00
Crude Protein	Dairy products	100.00
Calcium / Magnesium	Dairy products	300.00
Moisture	Dairy products	60.00
Phosphorus	Dairy products	100.00
pH measurement	Dairy products	60.00
Fat content	Milk	66.00
Hydrogen peroxide(Qualitative)	Milk	66.00
Lactose	Milk	100.00
Milk solid non fat	Milk	90.00
Titratable acidity	Milk	85.00
SPICES AND CONDIMENTS		
Acid-insoluble ash on dry basis	Spices and condiments	60.00
Added starch	Spices and condiments	60.00
Moisture	Spices and condiments	60.00
Volatile oil (on dry basis)	Spices and condiments	100.00
Piperine (on dry basis)	Spices and condiments	120.00
Total ash	Spices and condiments	60.00
Iodine value	Table salt	100.00
BEVERAGES		
Crude Protein	Beer, wine, soft drinks, fruit juices	100.00
Calcium / Magnesium	Beer, wine, soft drinks, fruit juices	300.00
Water content	Beer, wine, soft drinks, fruit juices	60.00
Phosphorus	Beer, wine, soft drinks, fruit juices	100.00
pH measurement	Beer, wine, soft drinks, fruit juices	60.00
Alcohol content (GC method)	Beer, wine, spirits	100.00
Alcohol content (Hydrometric)	Beer, wine spirits	60.00
Soluble sulphates	Wine	75.00
Solids content	Beer, wine, soft drinks, fruit juices	60.00
Acetic acid	Wine	75.00
Sulphur dioxide	wine	100.00

FOOD CHEMISTRY

CHEMICAL TESTS	MATRIX	COST(Rs)
OILS AND FATS		
Peroxide value	Oils and fats	85.00
Iodine value	Oils and fat	85.00
Refractive index	Oils and fat	60.00
Saponification value	Oils and fat	85.00
Acid value	Oils and fat	85.00
Specific gravity	Oils and fat	85.00
FRUIT AND FRUIT PRODUCTS		
Fill of container	Fruit products in jars	60.00
Soluble solids/Sugar content	Fruit and fruit products	60.00
Thickening agent (Pectic Acid)	Jam, jellies, marmalade	120.00
Total solids	Jam, jellies, marmalade	60.00
Benzoic and sorbic acid	Jam, jellies, marmalade	160.00
pH	Jam, jellies, marmalade	60.00
Ascorbic acid	Fruit and fruit products	160.00
CEREALS AND CEREAL PRODUCTS		
Crude Protein	Cereal products	100.00
Calcium / Magnesium	Cereal products	300.00
Moisture	Cereal products	60.00
Phosphorus	Cereal products	100.00
Total ash	Cereal products	60.00
Crude fibre	Bread / flour	160.00
Propionic acid	Bread	160.00
Moisture	Bread	60.00
ANIMAL FEED AND FORAGE		
Phosphorus	Feed and forage	100.00
Crude Protein	Feed and forage	100.00
Calcium / Magnesium	Feed and forage	300.00
Moisture	Feed and forage	60.00
MEAT AND POULTRY		
Phosphorus	Meat and poultry	100.00
Crude Protein	Meat and poultry	100.00
Calcium / Magnesium	Meat and poultry	300.00
Moisture	Meat and poultry	60.00
Fat analysis	Meat and poultry	85.00
pH measurement	Meat and poultry	60.00
Moisture	Meat and poultry	60.00
WATER, FRUIT AND VEGETABLES		
Pesticides	Water and Fruit/vegetables	160.00

ANNEXE 5

PUBLICATION WEST NILE

Seychelles Medical & Dental Journal- Victoria Hospital, Mahé, Seychelles
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Antibody prevalence of Dengue and West Nile viruses in the Seychelles

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Abstract

A serosurvey was conducted in Seychelles in a non-randomized sample of 490 subjects aged 2-94 years in May-August 1997 following epidemics of an influenza-like illness in December 1996 - February 1997 and of sore throat in March-April 1997. Tests were performed for IgG and IgM antibodies by ELISA for dengue 1 and dengue 2 viruses, West Nile, Wesselsbron, Sindbis and Chikungunya. None of the participants had IgM antibodies against the different viruses tested. The presence of dengue 1 or 2 IgG antibodies was detected in 24/490 (4.9%) and 20/490 individuals (4.1%) respectively. Only 2 patients born after the last known epidemic in Seychelles (January 1978) had dengue 2 antibodies. West Nile IgG antibodies increased from 18.4% in subjects aged 0-14 to 51.7% in persons aged more than 44. Antibodies against Wesselsbron, Sindbis or Chikungunya were not recorded in the studied population. In conclusion, these data support the view that no epidemic of dengue has taken place since 1978, that West-Nile virus has been encountered in the past, and that the other viruses have not been present recently in Seychelles. (SMDJ, 1999;6:18-20.)

Introduction

Dengue and West Nile viruses are members of the *Flaviviridae* family and transmitted principally in a cycle involving humans and mosquitoes. Infections caused by these viruses are mostly asymptomatic. In the last 25 years, the worldwide frequency of dengue fever outbreaks has increased and dengue became the most important arthropod-borne viral disease of humans with an estimated 50 million cases annually. A severe form of the disease, the dengue hemorrhagic fever (DHF), was first recognized in the Philippines in 1953 and subsequently reported in most countries of South Asia, then appeared during the 1980s in the Americas (14). The principal domestic vector of the four types of dengue virus (dengue 1, 2, 3 and 4) is *Aedes aegypti*, but *Ae. albopictus* mosquito is claimed to be the sole vector in some areas (15).

West Nile (WN) virus, associated with *Culex* mosquitoes and birds, is widely disseminated in Africa, in South-western Asia, and in the Mediterranean region. The disease in humans generally is reported as an influenza-like illness but recently encephalitic forms with fatal outcome were described (11,17). Other virus indistinguishable from West Nile, the Japanese encephalitic (JE) virus is circulating in Asia. Approximately 35,000-50,000 cases of JE with 10,000 fatalities are reported annually in Asia and about half of the survivors tend to have permanent neurologic and psychiatric sequelae (5). The cycle of maintenance of JE virus also involves *Culex* mosquito species, birds, pigs and humans. The incidence of the disease is increasing during the last ten years in India, Nepal and Sri Lanka. Infected mosquitoes from pig breeding farms are one of the most common source of human contamination.

The Republic of Seychelles consists of 115 islands scattered over 400 000 km² in the Indian Ocean (45° to 60 ° East, 4 to 11° South) with a total land area of about 450 km², with a total population of 75 000. Mahé, the main island with Victoria, the capital, is inhabited by 80% of the total population. The wet season extends from December to March and the average temperature ranges from 26° to 35°C in April-May. Annual rainfall ranges from 2 000 to 3 000 mm. From December 1976 to September 1977, an outbreak of dengue 2 fever with a clinical picture of classical dengue was recorded, affecting approximately 75% of the population (13). Then an outbreak of dengue was reported in La Réunion in 1977-1978 (7). A second dengue-like outbreak occurred in the Seychelles during the months of December 1978 and January 1979 (6). During the epidemic, the presence of *Ae. aegypti* was restricted to a few areas of Victoria only, and the virus was probably transmitted by *Ae. albopictus* mosquitoes (13). An entomological survey conducted in Mahé in 1995 showed a high prevalence of *Ae. albopictus*. The Breteau index varied between 17.0 to 100.0% and the house index from 14.3 to 53.3% (3). Likewise, a low density of *Ae. aegypti* distribution was registered, always in limited areas. Similar situation was recorded in La Réunion where *Ae. aegypti* was located in a few remote areas (16).

A possible introduction of the virus in the Seychelles in 1977 from South East Asia was suspected. Relationships were found by sequence analysis between the 1977 dengue 2 strain from the Seychelles and strains isolated in 1976 from Indonesia. Likewise similarities were observed with strains isolated later in Sri Lanka in 1982, 1985 and 1990, in Burkina Faso in 1983, and in Somalia in 1984 (8,12). In the South West region of the Indian Ocean, the last epidemic of dengue (dengue 1) was reported in 1993 in the Comoros islands (4). All cases recorded in the region were reported as classical dengue fever. However, an imported fatal case of DHF was confirmed in Mauritius in November 1996. The patient was travelling from New Delhi, India, where a large outbreak occurred at that time (1). No vaccine for dengue are presently available but several candidates are on clinical trials with as yet no satisfactory results. A commercial JE vaccine (Biken Ô) is used in hyper-endemic areas of Asia.

An influenza-like epidemic occurred in December 1996-February 1997 and several thousands of persons reported to health centers. In March –April 1997, a large number of patients reported to health centers for sore throat. These epidemics prompted to examine the seroprevalence of dengue in Seychelles.

Material and methods

A serological study was conducted by the Ministry of Health from May to August 1997 in the general population to assess any recent activity of dengue. In this study, 490 individuals (253 females and 237 males, aged 2 to 94) were selected in a non random manner and on a voluntary basis. These persons were selected mostly in health centers and among schools. Blood specimens were collected as well as clinical data and travel history. Serum samples were tested by immunocapture enzyme-linked immunosorbent assay (ELISA) for detection of IgG and IgM antibodies to dengue 1, dengue 2, and West Nile viruses in the Pasteur Institute in Madagascar. Using similar techniques, sera were tested for the presence of IgG/IgM antibodies against other arboviruses (Wesselsbron, Sindbis and Chikungunya) that may be present in this region of the Indian Ocean.

Table 1. Distribution of IgG antibodies to Dengue 1, Dengue 2 and West-Nile viruses in the human population from the Seychelles (May-Aug 1997)

Age	Tested	Female	Male	Dengue 1 IgG		Dengue 2 IgG		West Nile IgG	
Years	No.	No.	No.	No.	%	No.	%	No.	%
0-14	38	18	20	0	0.0	0	0.0	7	18.4
15-29	204	102	102	6	2.9	4	2.0	70	34.3
30-44	159	82	77	11	6.9	12	7.5	67	42.1
³ 45	89	51	38	7	7.9	4	4.5	46	51.7
Total	490	253	237	24	4.9	20	8.4	190	38.8

Results

The influenza-like illness occurring in December 1996 - February 1997 was reported by 5.5 % of the participants to this study while 2.2% of the participants reported to have suffered from the sore throat epidemics in March – April 1997.

Dengue 1 IgG antibody was detected in 24 of 490 (4.9%); dengue 2 IgG antibody in 20 of 490 individuals (4.1%); and 12 individuals had both antibodies (**Table 1**). None of the 242 patients born after the 1977 epidemic had dengue 2 IgG antibodies, but two of them (0.8%) had dengue 1 IgG antibodies. Dengue 1 or 2 and West Nile IgM antibodies were not detected in any of the sera tested. West Nile IgG antibodies were found in 190 (39 %) patients, with an increasing prevalence according to the age, reaching 51.7% in the ³ 45 year age group. Twenty-five individuals had both West Nile and dengue 1 or 2 IgG antibodies. Antibodies against Wesselsbron, Sindbis or Chikungunya were not detected in the studied population.

Discussion

Negative IgM results suggest an absence of recent dengue or West Nile infection in the population and no relationship was observed between serological results and reported clinical data. Symptoms of previous dengue-like illness were registered independently of the presence of *Flaviviridae* antibodies in blood specimens. Mild dengue or West Nile infection could be confused with influenza. If the studied population was considered representative of the population of the island, an estimate of at least 2 900 cases of influenza like illness would have occurred in December 1996 – February 1997 in the Seychelles. Follow-up of such

outbreaks would be useful in the future for an etiology identification of the disease with influenza virus detection as reported in La Reunion in 1996 (10). Within the *Flaviviridae* family, antigenic cross-reactions between viruses are common and may explain some of the dengue antibody positive cases. In 1977, dengue cross reacting IgG antibodies were detected in only 7.4% of the possibly estimated infected population (6). The presence of IgG dengue antibodies in three individuals of 15, 18 and 19 years of age without travel history could indicate a possible low activity of dengue virus or other cross reacting flavivirus in the area.

West Nile antibodies had been previously recorded in the Republic of Seychelles in only 3.1% of the population tested in 1979 (6). West Nile virus is associated with birds and mosquito vectors, mainly from he *Culex* genera and has a widespread distribution in Africa. The virus is endemic in Madagascar and was isolated from humans, birds (parrots, egrets) and from *Culex*, *Aedes* and *Anopheles* mosquitoes (9). A similar situation may be observed in the Seychelles. The recent encephalitic forms of WN infections were described in non endemic areas (e.g. Algeria, Tunisia, Romania). The geographic distribution of JE and WN virus are different with the exception of several states in India where both viruses are circulating. Close relationships between WN and JE viruses do not permit to differentiate them by ELISA or either by cross-neutralization test (17). The main vector of JE and WN, *Cx tritaeniorhynchus,* is present in the Seychelles (2). Japanese encephalitis could be introduced in the Seychelles via migrating birds.

Otherwise, an absence of Chikungunya and Sindbis infections was observed in the studied population in 1997, but evidence of few human infections had been previously found in 1979 (6). Antibodies to Wesselsbron, other flavivirus present in Africa and Madagascar and inducing generally a mild influenza-like illness in humans was not recorded in the studied population.

The last dengue epidemic in the Indian Ocean was reported in 1993 in the Grande Comore island, Federal Islamic Republic of Comoros, in relationship with a high density of *Ae. aegypti* mosquitoes (4). The low density of *Ae. aegypti* mosquitoes in the Seychelles, in La Réunion and in Madagascar (S Laventure, personal communication) may prevent dengue outbreaks in the next future. However, the circumstances of its replacement by *Ae. albopictus* as reported vector in 1977 are unclear. The DHF case identified in Mauritius in 1996 emphasizes the importance of etiologic investigation of suspicious cases including hemorrhagic fevers (e.g. leptospirosis, arbovirus) and encephalitis, in consideration of travel history.

The mosquito control is a continuous mass movement, and the population education on source reduction of larval mosquito breeding sites must be enforced. Further investigations on arbovirus circulation in the Seychelles are needed, including surveillance of animal and bird populations, as well as potential vectors, mosquitoes and ticks.

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